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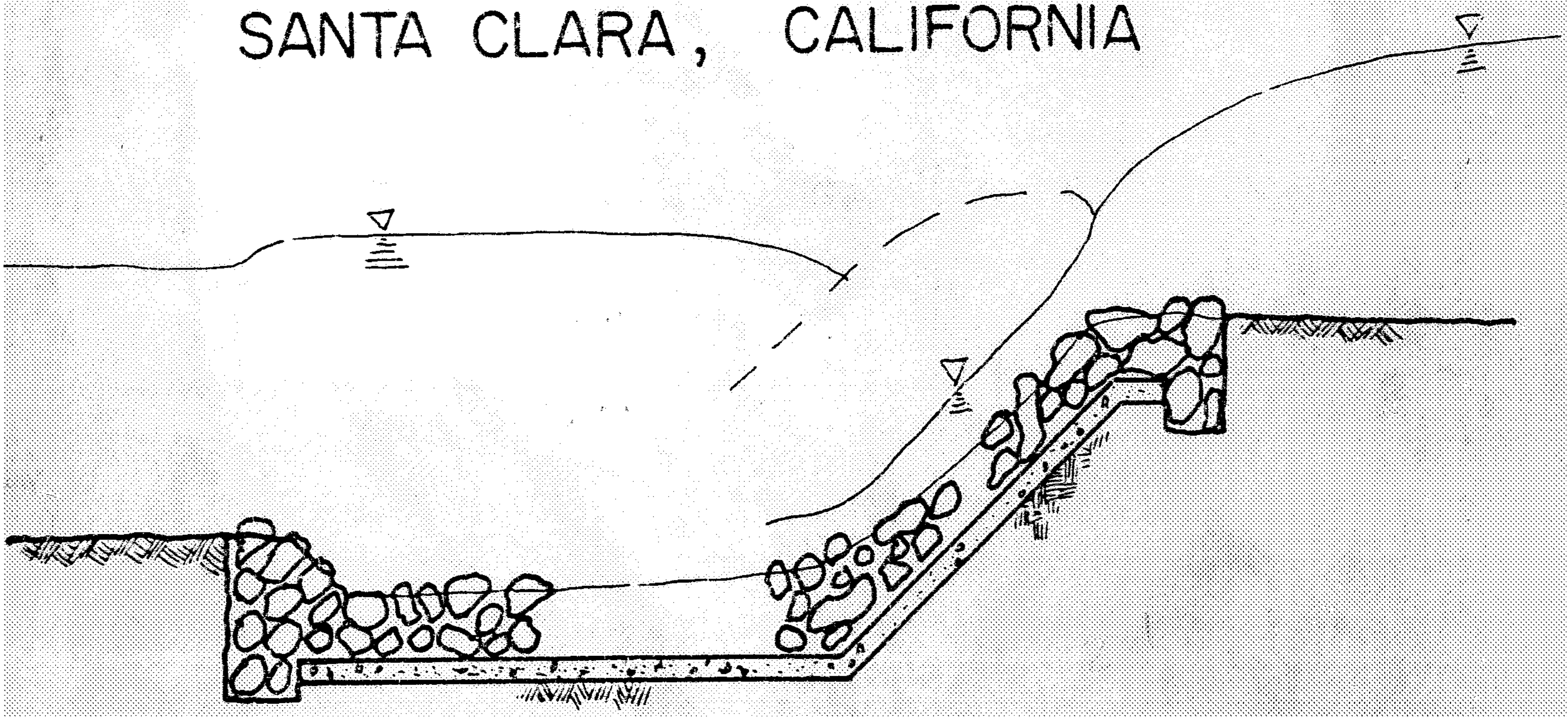
VOLUME II

LLAGAS CREEK

REACH 3A AND 9
FINAL DESIGN REPORT

LOWER LLAGAS CREEK WATERSHED
SANTA CLARA, CALIFORNIA



PREPARED BY
CALIFORNIA STATE OFFICE
ENGINEERING DESIGN SECTION
DAVIS, CALIFORNIA
FOR
SANTA CLARA VALLEY WATER DISTRICT
LOMA PRIETA SOIL CONSERVATION DISTRICT
GAVILAN WATER DISTRICT

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SEPTEMBER 1984

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UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

DESIGN SECTION

DAVIS, CALIFORNIA

FINAL DESIGN REPORT

FOR

LOWER LLAGAS CREEK REACH'S 3A AND 9A

SEPTEMBER 1984

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QUANTITIES

ENGINEER’S ESTIMATE

CONSTRUCTION SCHEDULE

BID SCHEDULE

BID SCHEDULE
LLAGAS CREEK REACH 3A & 9A

ITEM NO.	WORK OR MATERIAL	SPEC. NO.	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT
1.	Mobilization	8	JOB	L.S.	XXXXX	$
2.	Clearing & Grubbing	2	JOB	L.S.	XXXXX	$
3.	Structure Removal	3	JOB	L.S.	XXXXX	$
4.	Pollution Control	5	JOB	L.S.	XXXXX	$
5.	Removal of Water	11	JOB	L.S.	XXXXX	$
6.	Excavation, Common	21		C.Y.	$	$
7.	Earth Fill	23		C.Y.	$	$
8.	Filter Material	24		C.Y.	$	$
9.	Bedding Material	24		C.Y.	$	$
10.	Loose Rock Riprap	61		TON	$	$
11.	Grouted Rock Riprap	62		TON	$	$
12.	Grout	62		C.Y.	$	$
13	Metal Plates	81		EACH	$	$
14.	Vegetative Cover	6		ACRE	$	$
15.	Willow Cuttings	400		L.F.	$	$
16.	Public Safety	402	JOB	L.S.	XXXXXX	$
17.	18-Inch CMP	51		L.F.	$	$
					TOTAL	$

FEDERAL AQUISITON REGULATIONS

CONTRACT SPECIFICATIONS

CONSTRUCTION SPECIFICATION

2. CLEARING AND GRUBBING

1. SCOPE

The work shall consist of the clearing and grubbing of designated areas by removal and disposal of trees, snags, logs, stumps, shrubs and rubbish.

2. MARKING

The limits of the areas to be cleared and grubbed will be marked by means of stakes, flags, tree markings or other suitable methods. Trees to be left standing and uninjured will be designated by special markings placed on the trunks at a height of about six feet above the ground surface.

3. REMOVAL

All trees not marked for preservation and all snags, logs, brush, stumps, shrubs and rubbish shall be removed from within the limits of the marked areas. Unless otherwise specified, all stumps, roots and root clusters having a diameter of one inch or larger shall be grubbed out to a depth of at least two feet below subgrade elevation for concrete structures and one foot below the ground surface at embankment sites and other designated areas.

Please don't allow this. Please make them cart the crap off! There are commercial dump sites available. we have both air and groundwater quality problems in Santa Clara County and we should not exacerbate the problem.

4. DISPOSAL

Unless otherwise specified, all materials removed from the cleared and grubbed areas shall be burned or buried at locations approved by the Engineer or otherwise disposed of as approved by the Engineer.

5. MEASUREMENT AND PAYMENT

For items of work for which specific lump sum prices are established in the contract, payment for clearing and grubbing will be made at the contract lump sum price. Such payment shall constitute full compensation for all labor, equipment, tools and all other items necessary and incidental to completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

6. ITEM OF WORK AND CONSTRUCTION DETAILS

Item of work to be performed in conformance with this specification and the construction details is:

a. Bid Item 2, Clearing and Grubbing

(1) This item shall consist of clearing and grubbing the entire area within the right-of-way except for those areas and trees designated on the drawings or by the engineer to be preserved in place. This item shall also include removal and disposal of excess rubbish, such as car bodies and miscellaneous trash.

(2) Soil removal shall be held to the minimum necessary to accomplish clearing of trees, brush and shrubs and shall generally not exceed 0.3 foot in depth.

(3) The Contractor shall not damage or scar other trees except for necessary limbing to provide room for construction. If it is necessary to limb a tree, the cut shall be made with a saw and the wound shall be dressed with a tree seal. Any tree that is removed without the engineer's permission or is irreparably damaged shall be replaced with two 15 gallon size valley oak (Quercus lobata) trees as directed by the Engineer. Any tree from which bark has been removed from one-third or more of the circumference shall be considered irreparably damaged to an extent requiring removal. Removal and replacement of damaged trees shall be at the Contractor's expense.

(4) In Section 4, Disposal, all cleared and grubbed material resulting from this work shall be removed from the construction site and disposed of by the Contractor at sites of his own choosing.

OK, good!

CONSTRUCTION SPECIFICATION

3. STRUCTURE REMOVAL

1. SCOPE

The work shall consist of the removal, salvage and disposal of structures (including fences) from the designated areas.

2. MARKING

The limits of the areas from which structures must be removed will be marked by means of stakes, flags or other suitable methods. Structures to be preserved in place or salvaged will be designated by special markings.

3. REMOVAL

Within the areas so marked all visible structures and attachments and all buried structures located and identified by survey stakes shall be removed to the specified extent and depth.

4. SALVAGE

Structures that are designated to be salvaged shall be carefully removed and neatly placed in the specified storage areas. Salvaged structures that are capable of being disassembled shall be dismantled into individual members or sections. Such structures shall be neatly match marked with paint prior to disassembly. All pins, nuts, bolts, washers, plates and other loose parts shall be marked or tagged to indicate their proper locations in the structure and shall be fastened to the appropriate structural member or packed in suitable containers. Materials from fences designated to be salvaged shall be placed outside the work area on the property from which they were removed. Wire shall be rolled into uniform rolls of convenient size. Posts and rails shall be neatly piled.

5. DISPOSAL OF REFUSE MATERIALS

Do not allow this. Please require disposal the same as under Clearing & Grubbing.

Unless otherwise specified, refuse materials resulting from structure removal shall be burned or buried at locations approved by the Engineer or otherwise disposed of as specified or as approved by the Engineer.

6. MEASUREMENT AND PAYMENT

For items of work for which specific lump sum prices are established in the contract, payment for structure removal will be made at the contract lump sum price.

Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 3, Structure Removal

(1) This item shall consist of the removal of all designated structures within the right-of-way that interfere with completion of the construction shown on the drawings and in these specifications.

(2) In Section 2, Marking, in the event of damage, as a result of the Contractor's operations, to structures designated to be preserved, they shall be immediately restored by the Contractor to their "before" condition at his own expense.

(3) In Section 5, Disposal of Refuse Material, all refuse materials resulting from this work shall be removed from the construction site and disposed of by the contractor at sites of his own choosing.

CONSTRUCTION SPECIFICATION

5. POLLUTION CONTROL

1. SCOPE

The work shall consist of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air during construction operations in accordance with these specifications.

2. MATERIALS

All materials furnished shall meet the requirements of the Material Specifications listed in Section 8 of this specification.

3. EROSION AND SEDIMENT CONTROL MEASURES AND WORKS

The work and measures shall include but not be limited to the following, as shown on the drawings or as specified in Section 8 of this specification.

Staging of Earthwork Activities - The excavation and moving of soil materials shall be scheduled so that the smallest possible areas will be unprotected from erosion for the shortest time feasible.

Seeding - Seeding to protect disturbed areas shall be used as specified on the drawings or in Section 8 of this specification.

Mulching - Mulching shall be used to provide temporary protection to soil surfaces from erosion.

Diversions - Diversions shall be used to divert water away from work areas and/or to collect runoff from work areas for treatment and safe disposition.

Stream Crossings - Stream crossings shall be used where fording of streams by equipment is necessary.

Sediment Basins - Sediment basins shall be used to settle and filter out sediment from eroding areas to protect properties and streams below the construction site.

Straw Bale Filters - Straw bale filters shall be used to trap sediment from areas of limited runoff. Bales are temporary and shall be removed when permanent measures are installed.

Waterways - Waterways shall be used for the safe disposal of runoff from fields, diversions and other structures or measures.

4. CHEMICAL POLLUTION

The Contractor shall provide tanks or barrels or construct a sump sealed with plastic sheets to be used to dispose of chemical pollutants produced as a by-product of the project's work such as drained lubricating or transmission oils, greases, soaps, asphalt, etc. At the completion of the construction work, the sump shall be covered or filled as directed by the Engineer. Storage tanks or barrels shall be removed from the site.

Sanitary facilities such as pit toilets, chemical toilets, or septic tanks shall not be placed adjacent to live streams, wells, or springs. They shall be located at a distance sufficient to prevent contamination of any water sources.

5. AIR POLLUTION

Local and state regulations concerning the burning of brush or slash or disposal of other materials shall be adhered to.

Fire prevention measures shall be taken to prevent the start or the spreading of fires which result from project work. Fire breaks or guards shall be constructed at locations as shown on the drawings.

All public access or haul roads used during construction of the project shall be sprinkled as required to fully suppress dust.

6. MAINTENANCE REMOVAL AND RESTORATION

All measures and works shall be adequately maintained in a functional condition as long as needed during the construction operation. All temporary measures shall be removed and the site restored to as nearly to original conditions as practicable as directed by the Engineer.

7. MEASUREMENT AND PAYMENT

For items of work for which specific lump sum prices are established in the contract, payment for pollution control will be made at the contract lump sum price. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items, and the items to which they are made subsidiary, are identified in Section 8 of this specification.

8. ITEMS OF WORK AND CONSTRUCTION DETAILS

Item of work to be performed in conformance with this specification and the construction details is:

a. Bid Item 4, Pollution Control

(1) This item shall consist of the control of water and air pollution as required under this contract.

(2) In Section 3, Erosion and Sediment Control Measures and Works, the Contractor shall furnish the Engineer a written plan for the control of sediment at least 14 days prior to starting any excavation. The plan shall address all items except Seeding, and Mulching i Section 3. The plan must be approved by the Engineer before starting any excavation. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

(3) In Section 5, Air Pollution, firebreaks or guards will not be required.

(4) In Section 7, Measurement and Payment, partial payment will be made proportionate to the total value of all bid items completed on the date of the estimate except Pollution Control and Removal of Water.

CONSTRUCTION SPECIFICATION

6. SEEDING, SPRIGGING AND MULCHING FOR PROTECTIVE COVER

1. SCOPE

The work shall consist of preparing the area for treatment, furnishing and placing seed, sprigs, mulch, fertilizer, inoculant, soil amendments, and asphalt emulsion as specified in the designated areas.

2. MATERIALS

Seed - All seed shall conform to the current rules and regulations of the state where it is being used and from the latest crop available. It shall meet or exceed the standards for purity and germination listed in Section 7.

Seed shall be labeled in accordance with the state laws and the U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act in effect on the date of invitations for bids. Bag tag figures will be evidence of purity and germination. No seed will be accepted with a date of test of more than 9 months prior to the date of delivery to the site.

Seed that has become wet, moldy, or otherwise damaged in transit or storage will not be accepted. The percent of noxious weed seed allowable shall be as defined in the current state laws relating to agricultural seeds. Each type of seed shall be delivered in separate sealed containers and fully tagged unless exception is granted in writing by the Contracting Officer.

Fertilizer - Unless otherwise specified, the fertilizer shall be a commercial grade fertilizer. The fertilizer shall meet the standard for grade and quality specified by state law. Where fertilizer is furnished from bulk storage, the Contractor shall furnish a supplier's certification of analysis and weight. When required by the contract, a representative sample of the fertilizer shall be furnished the Contracting Officer for chemical analysis.

Inoculants - The inoculant for treating legume seeds shall be a pure culture of nitrogen-fixing bacteria prepared specifically for the species and shall not be used later than the date indicated on the container or as otherwise specified. A mixing medium, as recommended by the manufacturer, shall be used to bond the inoculant to the seed. Two times the amount of the inoculant recommended by the manufacturer shall be used, except when seed is applied by use of a hydraulic seeder, four times the amount of inoculant recommended by the manufacturer shall be used. Seed shall be sown within 24 hours of treatment and shall not remain in the hydraulic seeder longer than 4 hours.

Soil Amendments - Lime shall consist of Standard Ground Agricultural Limestone, or approved equivalent. Standard Ground Agricultural Limestone is defined as ground limestone meeting current requirements of the State Department of Agriculture.

Asphalt Emulsion shall conform to the requirements of ASTM D-977, "Emulsified Asphalt." The emulsified asphalt may be rapid setting, medium setting, or slow setting.

Straw Mulch Materials shall consist of wheat, oat, or rye straw, hay, grass cut from native grasses or other plants approved by the Contracting Officer. The mulch material shall be air dry, reasonably light in color, and shall not be musty, moldy, caked, or otherwise of low quality. The use of mulch that contains noxious weeds will not be permitted. The Contractor shall provide a method satisfactory to the Contracting Officer for determining weight of mulch furnished.

Other Mulch Materials - Mulching materials, such as wood cellulose fiber mulch, mulch tackifiers, synthetic fiber mulch, netting, and mesh are other mulching materials that may be required for specialized locations and conditions. These materials, when specified, must be accompanied by the manufacturers' recommendations for methods of application.

3. SEEDING MIXTURES, SOD, SPRIGS AND DATES OF PLANTING

The per acre rate for seed mixtures, sprigs, or sod and date of seeding or planting shall be as specified in Section 7, shown on the vegetating plan, or as otherwise approved by the Contracting Officer.

4. SEED BED PREPARATION AND TREATMENT

Areas to be treated shall be dressed to a smooth, firm surface.

On sites where equipment can operate, (generally slopes flatter than 1-1/2 to 1), the seedbed shall be adequately loosened (4 to 6 inches deep) and smoothed. Disking or cultipacking or both may be necessary as determined by the Contracting Officer.

On sites where equipment cannot operate, the seedbed shall be prepared by hand by scarifying to provide a roughened surface so that broadcast seed will stay in place.

If seeding is to be done immediately following construction, seedbed preparation may not be required except on compacted, polished, or freshly cut area.

Rocks larger than 6 inches in diameter, trash, weeds, and other debris that will interfere with seeding or maintenance shall be removed or disposed of as directed by the Contracting Officer.

Seedbed preparation shall be suspended when soil moisture conditions are not suitable for the preparation of a satisfactory seedbed as determined by the Contracting Officer.

5. SEEDING, SPRIGGING, FERTILIZING, MULCHING, AND STABILIZING

All seeding or sprigging operations shall be performed in such a manner that the seed or sprigs are applied in the specified quantities uniformly on the designated areas. The method and rate of seed application shall be as specified in Section 7. Unless otherwise specified, seeding or sprigging shall be done within 2 days after final grading is complete.

Fertilizer and soil amendments shall be applied as specified in Section 7. When specified the fertilizer and soil amendments shall be thoroughly incorporated into the soil as soon as possible after being applied.

The rate, amount, and kind of mulching or mesh shall be as specified in Section 7. Mulches shall be applied uniformly to the designated areas, and shall be applied to the seeded areas not later than 2 work days after seeding has been performed. Straw mulch materials shall be stabilized by the use of a disk or by a suitable tackifier. A disk harrow weighing as specified in Section 7 shall have the disks set straight and the harrow shall be used to'anchor the straw mulch into the soil as specified in Section 7.

The tackifier shall be applied uniformly over the mulch material at the specified rate, or by injecting it into the mulch material as it is being applied. The mesh or netting stabilizing materials shall be applied smoothly but loosely on the designated areas, and the edges shall be buried or securely anchored by means of spikes or staples as specified in Section 7.

The Contractor shall maintain the mesh or netting areas until all work on the entire contract has been completed and accepted. Maintenance shall consist of the repair of areas damaged by erosion, wind, fire, or other causes. Such areas shall be repaired to reestablish the condition and grade of the soil and shall be refertilized, reseeded, and remulched as directed by the Contracting Officer prior to application of the mesh or netting.

6. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, each area treated as specified will be measured to the nearest 0.1 acre. Payment for treatment will be made at the contract unit price for the designated treatment which shall constitute full compensation for all materials, labor, equipment, tools, and other items necessary and incidental to the completion of the work.

When specified as an item of work mesh or netting will be measured to the nearest square yard of surface area covered. Payment will be made at the contract unit price and shall constitute full compensation for labor, equipment, materials and other items necessary and incidental to the completion of work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

b. Bid Item 14, Vegetative Cover

(1) This item shall consist of seedbed preparation, fertilizing, seeding, and mulching all exposed earth structures within the right-of-way except the levee roads, maintenance roads and access ramps.

(2) In Section 2, Materials:

(a) Seed--All seed shall be delivered to the site, tagged and labeled in accordance with the California Agricultural Code, and shall be acceptable to the County Agricultural Commissioner.

Seed shall be of a quality which has a minimum pure live seed content of 80 percent (% purity X % germination) and weed seed shall not exceed 0.5 percent of aggregate of pure live seed and other material.

(b) Fertilizer--A commercial fertilizer shall be Ammonium Phosphate Sulfate and contain a minimum of 16 percent nitrogen, 20 percent available phosphoric acid and 0 percent water soluble potash, uniform in composition, dry and free flowing, pelleted or granular.

All bagged fertilizer shall be delivered in unbroken or unopened containers, labeled in accordance with applicable state regulations and bearing the warranty of the producer for the grade furnished.

(c) Soil amendments--No lime nor other soil amendments are specified.

(d) Mulch--Straw mulch shall be new straw derived from rice, wheat, oats, or barley. The Contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw obtained from outside the county is delivered to the site of the work.

(3) In Section 3, Seeding Mixtures and Dates of Planting:

(a) Seeding mixture--The following seed and seeding rate shall be used:

Kind of Seed and Amount	Pounds/Acre
Blando Brome (Bromis mollis)	18

The seeding rate shall be the weight of seed exclusive of any coating material.

Date of Planting--Planting shall be performed after final grading is completed. All seeding, fertilizing, and mulching operations shall not begin until approval is given by the Engineer.

(4) In Section 4, Seedbed Preparation and Treatment, the area to be seeded shall be roughened by scarifying, disking, harrowing, or otherwise worked to a depth of 2 to 4 inches then dressed to a reasonably smooth, firm surface.

No implement shall be used that will create an excessive amount of downward movement of soil or clods on sloping areas. Seedbed may be prepared at time of completion of earthmoving work.

(5) In Section 5, Seeding, Fertilizing, Mulching, and Stabilizing:

(a) Fertilizing:--Fertilizer shall be distributed uniformly over the seedbed at the rate of 500 pounds per acre.

Fertilizer shall be applied in any way that will result in uniform distribution. The fertilizer shall be incorporated into the soil. Incorporation may be as part of the seedbed preparation, or as part of the seeding operation. If fertilizing is part of the seedbed preparation, it shall not be accomplished more than fifteen (15) days prior to seeding.

(b) Seeding--Seed shall be drilled, broadcast by hand, mechanical hand seeder, power operated seeder, or other approved equipment. Seed shall be incorporated into the soil, but not more than one-half inch deep.

(c) Mulching--A straw mulch shall be distributed uniformly over the sloping areas at a rate of two tons per acre. The mulch shall be applied by hand, blower, or other suitable equipment. If straw is applied with a blower, it shall not be chopped in lengths less than (6) inches.

Application shall be made within 48 hours following seeding.

The mulch shall be anchored in place. Anchoring process as approved by the Engineer may include using hand tools, mulching rollers, disks, or similar types of suitable equipment.

CONSTRUCTION SPECIFICATION

8. MOBILIZATION

1. SCOPE

The work shall consist of the mobilization of the Contractor's forces and equipment necessary for performing the work required under the contract.

It shall include the purchase of contract bonds; transportation of personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary facilities at the site, and other preparatory work at the site.

It shall not include mobilization for any specific item of work for which payment for mobilization is provided elsewhere in the contract.

The specification covers mobilization for work required by the contract at the time of award. If additional mobilization costs are incurred during performance of the contract as a result of changed or added items of work for which the Contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the items of work changed or added.

2. PAYMENT

Payment will be made as the work proceeds, after presentation of invoices by the Contractor showing his own mobilization costs and evidence of the charges of suppliers, subcontractors, and others for mobilization work performed by them. If the total of such payments is less than the contract lump sum for mobilization, the unpaid balance will be included in the final contract payment. Total payment will be the lump sum contract price for mobilization, regardless of actual cost to the Contractor.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

Payment of the lump sum contract price for mobilization will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to completion of the work.

3. ITEMS OF WORK AND CONSTRUCTION DETAILS

Item of work to be performed in conformance with this specification and the construction details is:

a. Bid Item 1, Mobilization

(1) This item shall consist of the mobilization of the Contractor's forces and equipment, as described in Section 1, for the performance of all work required under the contract.

(2) Additional requirements:

(a) Field Office. The Contractor shall provide and maintain for the exclusive use of the Engineer, at a location convenient to the construction operations, one field office of the portable trailer type with a sink and toilet partitioned off from one end. Office shall be provided with an outside-door lock. The floor space occupied by the office shall be not less than 250 square feet. The office shall be located close to the Contractor's field office.

(b) Equipment. The Contractor shall furnish and install not less than two desks, two chairs, one file cabinet, one plan rack, and one plan table. The Contractor shall furnish and install the necessary electrical wiring, furnish light, heat, water; private telephone installation and removal, and weekly janitorial service in connection with said office shall be provided for the duration of the work. The Contractor shall remove said office and appurtenant facilities upon completion of the work.

(c) Private Phone Service. Private phone service for the Engineer shall be billed to the Service directly and will not be a part of mobilization.

CONSTRUCTION SPECIFICATION

11. REMOVAL OF WATER

1. SCOPE

The work shall consist of the removal of surface water and ground water as needed to perform the required construction in accordance with the specifications. It shall include (1) building and maintaining all necessary temporary impounding works, channels, and diversions, (2) furnishing, installing and operating all necessary pumps, piping and other facilities and equipment, and (3) removing all such temporary works and equipment after they have served their purposes.

2. DIVERTING SURFACE WATER

The Contractor shall build, maintain and operate all cofferdams, channels, flumes, sumps, and other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site and away from the construction work while construction is in progress. Unless otherwise specified, a diversion must discharge into the same natural drainageway in which its headworks are located.

Unless otherwise specified, the Contractor shall furnish to the Engineer, in writing, his plan for diverting surface water before beginning the construction work for which the diversion is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

3. DEWATERING THE CONSTRUCTION SITE

Foundations, cutoff trenches and other parts of the construction site shall be dewatered and kept free of standing water or excessively muddy conditions as needed for proper execution of the construction work. The Contractor shall furnish, install, operate and maintain all drains, sumps, pumps, casings, wellpoints, and other equipment needed to perform the dewatering as specified. Dewatering methods that cause a loss of fines from foundation areas will not be permitted.

Unless otherwise specified, the Contractor shall furnish to the Engineer, in writing, his plan for dewatering before beginning the construction work for which the dewatering is required. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

4. DEWATERING BORROW AREAS

Unless otherwise specified in Section 8, the Contractor shall maintain the borrow areas in drainable condition or otherwise provide for timely and effective removal of surface and ground waters that accumulate within the borrow areas from any source. Borrow material shall be processed as necessary to achieve proper and uniform moisture content for placement.

If pumping to dewater borrow areas is included as an item of work in the bid schedule, each pump used for this purpose shall be equipped with a water meter in the discharge line. Accuracy of the meters shall be such that the measured quantity of water is within 3 percent, plus or minus, of the true quantity. Means shall be provided by the Contractor to check the accuracy of the water meters when requested by the Engineer.

5. EROSION AND POLLUTION CONTROL

Removal of water from the construction site, including the borrow areas shall be accomplished in such a manner that erosion and the transmission of sediment and other pollutants are minimized.

6. REMOVAL OF TEMPORARY WORKS

After the temporary works have served their purposes, the Contractor shall remove them or level and grade them to the extent required to present a sightly appearance and to prevent any obstruction of the flow of water or any other interference with the operation of or access to the permanent works.

Except as otherwise specified, pipes and casings shall be removed from temporary wells and the wells shall be filled to ground level with gravel or other material approved by the Engineer.

7. MEASUREMENT AND PAYMENT

Method 1 Items of work listed in the bid schedule for removal of water, diverting surface water, dewatering construction sites, and dewatering borrow areas will be paid for at the contract lump sum prices. Such payment will constitute full compensation for all labor, equipment, tools, and all other items necessary and incidental to the completion of the work.

The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 8 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Item of work to be performed in conformance with this specification and construction details is:

a. Bid Item 5, Removal of Water

(1) This item shall consist of the removal and diversion of surface water and ground water as required to construct the works of improvement in the dry in accordance with these specifications.

(2) Work shall not be allowed when dewatering is insufficient for the work to be accomplished in the dry. The work site shall remain drained and useable for construction purposes for the duration of the construction season. Water shall not be allowed to stand or pond within the work site.

(3) It is anticipated that a water table and/or seepage from existing banks will be encountered during construction operations.

(4) The contractor shall remove all water which may accumulate in the excavation during the progress of work so that all work can be done in the dry. Trenches and foundation areas shall be kept free from water whale the improvements are installed and until backfilling has progressed to a height above the water source. The Contractor shall have sufficient pumping equipment available for immediate use. Water shall be disposed of in such a manner as to cause no injury to public or private property.

(5) In Section 2, Diverting Surface Water, and in Section 3, Dewatering the Construction Site, the Contractor shall submit his written plan five days in advance of starting the removal and diversion of surface water and ground water.

(6) Section 6, Measurement and Payment, shall apply. Partial payment of 40 percent of the lump sum price will be made with the system. The remaining 60 percent of the lump sum price will be made proportionate to the total value of all bid items, except Removal of Water and Pollution Control, completed on the date of the partial payment estimate.

CONSTRUCTION SPECIFICATION

21. EXCAVATION

1. SCOPE

The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials.

2. CLASSIFICATION

Excavation will be classified as common excavation or rock excavation in accordance with the following definitions or will be designated as unclassified.

Common excavation shall be defined as the excavation of all materials that can be excavated, transported, and unloaded by the use of heavy ripping equipment and wheel tractor-scrapers with pusher tractors or that can be excavated and dumped into place or loaded onto hauling equipment by means of excavators having a rated capacity of one cubic yard and equipped with attachments (such as shovel, bucket, backhoe, dragline or clam shell) appropriate to the character of the materials and the site conditions.

Rock excavation shall be defined as the excavation of all hard, compacted or cemented materials the accomplishment of which requires blasting or the use of excavators larger than defined for common excavation. The excavation and removal of isolated boulders or rock fragments larger than one cubic yard in volume encountered in materials otherwise conforming to the definition of common excavation shall be classified as rock excavation.

Excavation will be classified according to the above definitions by the Engineer, based on his judgment of the character of the materials and the site conditions.

The presence of isolated boulders or rock fragments larger than one cubic yard in size will not in itself be sufficient cause to change the classification of the surrounding material.

For the purpose of this classification, the following definitions shall apply:

Heavy ripping equipment shall be defined as a rear-mounted, heavy duty, single-tooth, ripping attachment mounted on a tractor having a power rating of 200-300 net horsepower (at the flywheel).

Wheel tractor-scraper shall be defined as a self-loading (not elevating) and unloading scraper having a struck bowl capacity of 12-20 yards.

Pusher tractor shall be defined as a track type tractor having a power rating of 200-300 net horsepower (at the flywheel) equipped with appropriate attachments.

3. UNCLASSIFIED EXCAVATION

Items designated as "Unclassified Excavation" shall include all materials encountered regardless of their nature or the manner in which they are removed. When excavation is unclassified, none of the definitions or classifications stated in Section 2 of this specification shall apply.

4. BLASTING

The transportation, handling, storage, and use of dynamite and other explosives shall be directed and supervised by a person of proven experience and ability in blasting operations.

Blasting shall be done in such a way as to prevent damage to the work or unnecessary fracturing of the foundation and shall conform to any special requirements in Section 12 of this specification.

5. USE OF EXCAVATED MATERIALS

To the extent they are needed, all suitable materials from the specified excavations shall be used in the construction of required permanent earthfill or rockfill. The suitability of materials for specific purposes will be determined by the Engineer. The Contractor shall not waste or otherwise dispose of suitable excavated materials.

6. DISPOSAL OF WASTE MATERIALS

All surplus or unsuitable excavated materials will be designated as waste and shall be disposed of by the Contractor at sites of his own choosing away from the site of the work.

7. BRACING AND SHORING

Excavated surfaces too steep to be safe and stable if unsupported shall be supported as necessary to safeguard the work and workmen, to prevent sliding or settling of the adjacent ground, and to avoid damaging existing improvements. The width of the excavation shall be increased if necessary to provide space for sheeting, bracing, shoring, and other supporting installations. The Contractor shall furnish, place and subsequently remove such supporting installations.

8. STRUCTURE AND TRENCH EXCAVATION

Structure or trench excavation shall be completed to the specified elevations and to sufficient length and width to include allowance for forms, bracing and supports, as necessary, before any concrete or earthfill is placed or any piles are driven within the limits of the excavation.

9. BORROW EXCAVATION

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fills, additional materials shall be obtained from the designated borrow areas. The extent and depth of borrow pits within the limits of the designated borrow areas shall be as directed by the Engineer.

Borrow pits shall be excavated and finally dressed in a manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions.

10. OVEREXCAVATION

Excavation in rock beyond the specified lines and grades shall be corrected by filling the resulting voids with portland cement concrete made of materials and mix proportions approved by the Engineer. Concrete that will be exposed to the atmosphere when construction is completed shall contain not less than 6 sacks of cement per cubic yard of concrete. Concrete that will be permanently covered shall contain not less than 4-1/2 sacks of cement per cubic yard. The concrete shall be placed and cured as specified by the Engineer.

Excavation in earth beyond the specified lines and grades shall be corrected by filling the resulting voids with approved compacted earthfill, except that, if the earth is to become the subgrade for riprap, rockfill, sand or gravel bedding, or drainfill, the voids may be filled with material conforming to the specifications for the riprap, rockfill, bedding or drainfill.

11. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and class of excavation within the specified pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Regardless of quantities excavated, the measurement for payment will be made to the specified pay limits, except that excavation outside the specified lines and grades directed by the Engineer to remove unsuitable material will be included. Excavation required because unsuitable conditions result from the Contractor's improper construction operations, as determined by the Engineer, will not be included for measurement and payment.

The pay limits shall be defined as follows:

a. The upper limit shall be the original ground surface as it existed prior to the start of construction operations except that where excavation is performed within areas designated for previous excavation or fill the upper limit shall be the modified ground surface resulting from the specified previous excavation or fill.

b. The lower and lateral limits shall be the neat lines and grades shown on the drawings.

Payment for each type and class of excavation will be made at the contract unit price for that type and class of excavation. Such payment will constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to the performance of the work, except that extra payment for backfilling required overexcavation will be made in accordance with the following provisions:

> Payment for backfilling overexcavation, as specified in Section 10 of this specification, will be made only if the excavation outside specified lines and grades is directed by the Engineer to remove unsuitable material and if the unsuitable condition is not a result of the Contractor's improper construction operations as determined by the Engineer.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 12 of this specification.

12. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 6, Excavation

(1) This item shall consist of all excavation required to construct all the improvements. These improvements include but are not limited to earth channel, rock riprap, and fish ladders.

CONSTRUCTION SPECIFICATION

23. EARTHFILL

1. SCOPE

The work shall consist of the construction of earth embankments and other earthfills required by the drawings and specifications.

2. MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing and disposition of materials in the various fills shall be subject to approval by the Engineer.

Fill materials shall contain no sod, brush, roots or other perishable materials. Rock particles larger than the maximum size specified for each type of fill shall be removed prior to compaction of the fill.

The types of materials used in the various fills shall be as listed and described in the specifications and drawings.

3. FOUNDATION PREPARATION

Foundations for earthfill shall be stripped to remove vegetation and other unsuitable materials or shall be excavated as specified.

Except as otherwise specified, earth foundation surfaces shall be graded to remove surface irregularities and shall be scarified parallel to the axis of the fill or otherwise acceptably scored and loosened to a minimum depth of 2 inches. The moisture content of the loosened material shall be controlled as specified for the earthfill, and the surface materials of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

Earth abutment surfaces shall be free of loose, uncompacted earth in excess of two inches in depth normal to the slope and shall be at such a moisture content that the earthfill can be compacted against them to effect a good bond between the fill and the abutments.

Rock foundation and abutment surfaces shall be cleared of all loose materials by hand or other effective means and shall be free of standing water when fill is placed upon them. Occasional rock outcrops in earth foundations for earthfill, except in dams and other structures designed to restrain the movement of water, shall not require special treatment if they do not interfere with compaction of the foundation and initial layers of the fill or the bond between the foundation and the fill.

Foundation and abutment surfaces shall be not steeper than 1 horizontal to 1 vertical unless otherwise specified. Test pits or other cavities shall be filled with compacted earthfill conforming to the specifications for the earthfill to be placed upon the foundation.

4. PLACEMENT

Fill shall not be placed until the required excavation and foundation preparation have been completed and the foundation has been inspected and approved by the Engineer. Fill shall not be placed upon a frozen surface, nor shall snow, ice, or frozen material be incorporated in the fill.

Fill shall be placed in approximately horizontal layers. The thickness of each layer before compaction shall not exceed the maximum thickness specified. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified thickness before being compacted. Hand compacted fill, including fill compacted by manually directed power tampers, shall be placed in layers whose thickness before compaction does not exceed the maximum thickness specified for layers of fill compacted by manually directed power tampers.

Adjacent to structures, fill shall be placed in a manner which will prevent damage to the structures and will allow the structures to assume the loads from the fill gradually and uniformly. The height of the fill adjacent to a structure shall be increased at approximately the same rate on all sides of the structure.

Earthfill in dams, levees and other structures designed to restrain the movement of water shall be placed so as to meet the following additional requirements:

a. The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material.

b. If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

c. The top surfaces of embankments shall be maintained approximately level during construction, except that a crown or cross-slope of approximately 2 percent shall be maintained to insure effective drainage, and except as otherwise specified for drainfill or sectional zones. If the drawings or specifications require or the Engineer directs that fill be placed at a higher level in one part of an embankment than another, the top surface of each part shall be maintained as specified above.

d. Dam embankments shall be constructed in continuous layers from abutment to abutment except where openings to facilitate construction or to allow the passage of stream flow during construction are specifically authorized in the contract.

e. Embankments built at different levels as described under (c) or (d) above shall be constructed so that the slope of the bonding surfaces between embankment in place and embankment to be placed is not steeper than 3 feet horizontal to 1 foot vertical. The bonding surface of the embankment in place shall be stripped of all loose material, and shall be scarified, moistened and recompacted when the new fill is placed against it as needed to insure a good bond with the new fill and to obtain the specified moisture content and density in the junction of the in place and new fills.

5. CONTROL OF MOISTURE CONTENT

During placement and compaction of fill, the moisture content of the materials being placed shall be maintained within the specified range.

The application of water to the fill materials shall be accomplished at the borrow areas insofar as practicable. Water may be applied by sprinkling the materials after placement on the fill, if necessary. Uniform moisture distribution shall be obtained by disking.

Material that is too wet when deposited on the fill shall either be removed or be dried to the specified moisture content prior to compaction.

If the top surface of the preceding layer of compacted fill or a foundation or abutment surface in the zone of contact with the fill becomes too dry to permit suitable bond it shall be scarified and moistened by sprinkling to an acceptable moisture content prior to placement of the next layer of fill.

6. COMPACTION

Earthfill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction. Each layer of fill shall be compacted as necessary to make the density of the fill matrix not less than the minimum density specified. The fill matrix is defined as the portion of the fill material finer than the maximum particle size used in the compaction test method specified.

Class B compaction. Each layer of fill shall be compacted to a mass density not less than the minimum density specified.

Class C compaction. Each layer of fill shall be compacted by the specified number of passes of the type and weight of roller or other equipment specified, or by an approved equivalent method. Each pass shall consist of at least one passage of the roller wheel or drum over the entire surface of the layer.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping if permitted by the Contracting Officer, or manually directed power tampers or plate vibrators. Unless otherwise specified, heavy equipment including backhoe mounted powertampers, or vibrating compactors and manually directed vibrating rollers, shall not be operated within 2 feet of any structure. Towed or self-propelled vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from a crane or hoist will not be permitted.

The passage of heavy equipment will not be allowed: (1) over cast-in-place conduits prior to 14 days after placement of the concrete; (2) over cradled or bedded precast conduits prior to 7 days after placement of the concrete cradle or bedding; or (3) over any type of conduit until the backfill has been placed above the top surface of the structure to a height equal to one-half the clear span width of the structure or pipe or 2 feet, whichever is greater.

Compacting of fill adjacent to structures shall not be started until the concrete has attained the strength specified in Section 10 for this purpose. The strength will be determined by compression testing of test cylinders cast by the Engineer for this purpose and cured at the work site in the manner specified in ASTM Method C 31 for determining when a structure may be put into service.

When the required strength of the concrete is not specified as described above, compaction of fill adjacent to structures shall not be started until the following time intervals have elapsed after placement of the concrete.

Structure	Time Interval
Retaining walls and counterforts (Impact basins)	14 days
Walls backfilled on both sides simultaneously	7 days
Conduits and spillway risers, cast-in-place (with inside forms in place)	7 days
Conduits and spillway risers, cast-in-place (inside forms removed)	14 days
Conduits, precast, cradled	2 days
Conduits, precast, bedded	1 day
Antiseep collars and cantilever outlet bents (Backfilled both sides simultaneously)	3 days

7. REWORKING OR REMOVAL AND REPLACEMENT OF DEFECTIVE FILL

Fill placed at densities lower than the specified minimum density or at moisture contents outside the specified acceptable range of moisture content or otherwise not conforming to the requirements of the specifications shall be reworked to meet the requirements or removed and replaced by acceptable fill. The replacement fill and the foundation, abutment and fill surfaces upon which it is placed shall conform to all requirements of this specification for foundation preparation, approval, placement, moisture control and compaction.

8. TESTING

During the course of the work, the Engineer will perform such tests as are required to identify materials, to determine compaction characteristics, to determine moisture content, and to determine density of fill in place. These tests performed by the Engineer will be used to verify that the fills conform to the requirements of the specifications. Such tests are not intended to provide the Contractor with the information required by him for the proper execution of the work and their performance shall not relieve the Contractor of the necessity to perform tests for that purpose.

Densities of fill requiring Class A compaction will be determined by the Engineer in accordance with ASTM Method D 1556, 2167, 2922 or 2937 except that the volume and moist weight of included rock particles larger than those used in the compaction test method specified for the type of fill will be determined and deducted from the volume and moist weight of the total sample prior to computation of density or if using the nuclear gauge, added to the specified density to bring it to the measure of equivalent composition for comparison. The density so computed will be used to determine the percent compaction of the fill matrix. Moisture content will be determined by one of the following methods: ASTM Method D-2216, D-3017 unless otherwise specified.

9. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of each type and compaction class of earthfill within the specified zone boundaries and pay limits will be measured and computed to the nearest cubic yard by the method of average cross-sectional end areas. Unless otherwise specified, no deduction in volume will be made for embedded conduits and appurtenances.

The pay limits shall be as defined below, with the further provision that earthfill required to fill voids resulting from overexcavation of the foundation, outside the specified lines and grades, will be included in the measurement for payment only where such overexcavation is directed by the Engineer to remove unsuitable material and where the unsuitable condition is not a result of the Contractor's improper construction operations as determined by the Engineer.

The pay limits shall be the measured surface of the foundation when approved for placement of the fill and the specified neat lines of the fill surface.

Payment for each type and compaction class of earthfill will be made at the contract unit price for that type and compaction class of fill. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 10 of this specification.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 7, Earth Fill

(1) This item shall consist of all compacted earth fill necessary to construct the channel, the levees, and all other earth fill to the lines and grades as shown on the drawings.

(2) In Section 2, Materials, the maximum size of rock fragment incorporated into the fill shall not exceed 6 inches and within two feet of a pipe or structure, rocks shall not exceed 3 inches in diameter.

(3) In Section 4, Placement, the thickness of each layer of fill before compaction shall not be greater than 9 inches.

(4) In Section 5, Control of Moisture Content, the moisture content shall be within ± 2 percent of optimum.

(5) In Section 6, Compaction, Class B compaction shall be used. Earth fill shall be compacted to 90 percent of the maximum density obtained in compaction tests of the fill materials performed by Method "A" of ASTM D 698.

(6) In Section 8, Testings, field density of soil in place will be determined by the sand-cone method, however, the Engineer may elect to use other equivalent test methods for construction control purposes. In the event of any dispute, acceptability of the work will be based on test results determined by the sand-cone method.

INSERT

(a) Clay materials with Liquid Limits grater than 50 shall not be used for earth fill. They may be placed at disposal site No 1. These CH materials are most likely to be encountered at stations 194+00 and 242+00 in reach 3A.

(b) Clean sands and gravels shall be well mixed with ML or CL clays and silts if used for earth fill.

CONSTRUCTION SPECIFICATION

24 DRAINFILL

1. SCOPE

The work shall consist of furnishing, placing and compacting drainfill required in the construction of structure drainage systems.

2. MATERIALS

Drainfill materials shall conform to the requirements of Material Specification 521. At least 30 days prior to delivery of the materials to the site the Contractor shall inform the Contracting Officer in writing of the source from which he intends to obtain them. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing.

3. BASE PREPARATION

Foundation surfaces and trenches shall be clean and free of organic matter, loose soil, foreign substance, and standing water when the drainfill is placed. Earth surfaces upon or against which drainfill will be placed shall not be scarified.

4. PLACEMENT

Drainfill shall not be placed until the subgrade has been inspected and approved by the Engineer. Drainfill shall not be placed over or around pipe or drain tile until the installation of the pipe or tile has been inspected and approved.

Drainfill shall be placed uniformly in layers not more than 12 inches deep before compaction. When compaction is accomplished by manually controlled equipment, the layers shall be not more than 8 inches deep. the material shall be placed in a manner to avoid segregation of particle sizes and to insure the continuity and integrity of all zones. No foreign materials shall be allowed to become intermixed with or otherwise contaminate the drainfill.

Traffic shall not be allowed to cross over drains at random. Equipment crossovers shall be maintained, and the number and location of such crossovers shall be established and approved prior to the beginning of drainfill placement. Each crossover shall be cleaned of all contaminating materials and shall be inspected and approved by the Engineer before additional drainfill is placed.

Any damage to the foundation surface or the sides or bottoms of trenches occurring during placement of drainfill shall be repaired before drainfill placement is continued.

The upper surface of drainfill constructed concurrently with adjacent zones of earthfill shall be maintained at an elevation at least one foot above the upper surface of the adjacent fill.

Drainfill over or around pipe or drain tile shall be placed in manner to avoid any displacement in line on grade of the pipe or tile.

Drainfill shall not be placed adjacent to structures until the concrete has attained the strength specified in Section 9 of this specification. The strength shall be determined by compression testing of test cylinders cast by the Engineer for this purpose and cured at the work site in the manner specified in ASTM-C-31 for determining when a structure may be put in service.

When the required strength of the concrete is not specified as described above, placement of drainfill adjacent to structures shall not be started until the following item intervals have elapsed after placement of the concrete.

Structure	Time Interval
Retaining walls and counterforts (impact basins)	14 days
Walls backfilled on both sides simultaneously	7 days
Conduits and galleries, cast-in-place (with inside forms in place)	7 days
Conduits and galleries, cast-in-place (inside forms removed)	14 days
Conduits, precast, cradled	2 days
Conduits, precast, bedded	1 day
Antiseep collars and cantilever outlet bents backfilled on both sides simultaneously.	3 days

5. CONTROL OF MOISTURE

The moisture content of drainfill materials shall be controlled as specified in Section 9. When the addition of water is required, it shall be applied in such a way as to avoid excessive wetting to adjacent earth fill. Except as specified in Section 9, control of moisture content will not be required.

6. COMPACTION

Drainfill shall be compacted according to the following requirements for the class of compaction specified:

Class A compaction. Each layer of drainfill shall be compacted to a relative density of not less than 70 percent as determined by ASTM Method D-2049.

Class I compaction. Each layer of drainfill shall be compacted by at least 2 passes, over the entire surface, of a steel-drum vibrating roller weighing not less than 5 tons and exerting a vertical vibrating force of not less than 20,000 pounds at least 1200 times per minute, or by an approved equivalent method.

Class II compaction. Each layer of drainfill shall be compacted by one of the following methods or by an approved equivalent method:

a. At least 2 passes, over the entire surface, of a pneumatic- tired roller exerting a pressure of not less than 75 pounds per square inch. A pass is defined as at least one complete coverage of the roller wheel, tire or drum over the entire surface of the layer.

b. At least 4 passes, over the entire surface, of the track of a crawler-type tractor weighing not less than 20 tons.

c. Controlled movement of the hauling equipment so that the entire surface is traversed by not less than one tread track of the loaded equipment.

Class III compaction. No compaction will be required beyond that resulting from the placing and spreading operations.

When compaction other than Class III compaction is specified materials placed in trenches or other locations inaccessible to heavy equipment shall be compacted by means of manually controlled pneumatic or vibrating tampers or by approved equivalent methods.

Heavy equipment shall not be operated within 2 feet of any structure. Vibrating rollers shall not be operated within 5 feet of any structure. Compaction by means of drop weights operating from cranes or hoists will not be permitted.

7. TESTING

The Engineer will perform such tests as are required to verify that the drainfill materials and the drainfill in place meet the requirements of the specifications. These tests are not intented to provide the Contractor with information he needs to assure that the materials and workmanship meet the requirements of the specifications, and their performance will not relieve the Contractor of the responsibility of performing his own tests for that purpose.

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of drainfill within the neat lines shown on the drawings or limits established by the Engineer will be measured and computed to the nearest cubic yard. Where the Engineer directs placement of drainfill outside the neat lines to replace unsuitable foundation material, the volume of such drainfill will be included, but only to the extent that the unsuitable condition is not a result of the Contractor's operations.

Payment for drainfill will be made at the contract unit price for each type of drainfill, complete in place. Except as otherwise specified in Section 9, such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the performance of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary. Such items and the items to which they are made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. ITEM OF WORK AND CONSTRUCTION DETAILS

Item of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 8, Filter Material

(1) This item shall consist of the filter material as shown on the drawings.

(2) In Section 2, Materials:

(a) Material Specification 521 shall not apply. Filter material shall meet the following gradation requirements:

Sieve Size	Percent Passing (by weight)	
3/8"	100	
No. 4	95 - 100	~~100~~
No. 8	80 - 100	~~100~~
No. 16	50 - 85	~~85~~
No. 30	25 - 60	~~60~~
No. 50	10 - 30	~~30~~
No. 100	2 - 10	~~10~~
No. 200	0 - 05	~~05~~

Drain fill and filter aggregates shall be sand, gravel or crushed stone or mixtures thereof. They shall be composed of clean, hard, durable mineral particles free from organic matter, clay balls, soft particles or other substances that would interfere with their free-draining properties. Not more than 15 percent, by weight, shall be flat, elongated particles.

Aggregates of crushed limestone shall be thoroughly washed and screened. Coarse aggregates containing crushed limestone shall have not more than 3 percent, by weight, or particles finer than the No. 4 sieve. Crushed limestone shall not be used for fine aggregates except in combination with other materials such that not more than 5 percent of the portion finer than the No. 4 sieve shall be crushed limestone.

Aggregates shall be tested for soundness according to ASTM C 88, and shall have a weighted average loss in five cycles of not more than 12 percent when sodium sulfate is used or 18 percent when manganese iron sulfate is used.

Drain fill and filter aggregate shall conform to the specified grading limits after being placed in the work, and after being compacted if compaction is specified. Grading shall be determined by ASTM C 136, but the percentage of material finer than a No. 200 sieve shall be not more than 5 percent when determined by ASTM C 117.

Drain fill and filter aggregates shall be stored and handled by methods that prevent segregation of particle sizes or contamination by mixing with other materials.

(3) In Section 6, Compaction, class III compaction shall be used for filter material.

b. Bid Item 9, Bedding Material

(1) This item shall consist of the bedding material as shown on the drawings.

(2) In Section 2, Materials:

Bedding material shall meet the following gradation requirements:

Sieve Size (Inches)	Percent Passing (by weight)
4	100
3½	90 - 100
2½	25 - 60
1½	0 - 15
3/4	0 - 5

(3) Section a.(2)(a) in Bid Item 8, Filter Material, shall apply.

(4) In Section 6, Compaction, Class III compaction shall be used for bedding material.

CONSTRUCTION SPECIFICATION

32. CONCRETE FOR MINOR STRUCTURES

1. SCOPE

The work shall consist of furnishing, forming, placing, finishing and curing portland cement concrete as required to build the structures named in Section 24 of this specification.

2. MATERIALS

Portland cement shall conform to the requirements of Material Specification 531 for the specified type.

Aggregates shall conform to the requirements of Material Specification 522 unless otherwise specified. The grading of coarse aggregates shall be as specified in Section 24.

Water shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter or other deleterious substances.

Preformed expansion joint filler shall conform to the requirements of Material Specification 535.

Waterstops shall conform to the requirements of Material Specifications 537 and 538 for the specified kinds.

3. CLASS OF CONCRETE

Concrete for minor structures shall be classified as follows:

Class of Concrete	Maximum Net Water Content (gallons/bag)	Minimum Cement Content (bags/cu. yd.)
3000M	7	6
4000M	6	6

4. AIR CONTENT AND CONSISTENCY

Unless otherwise specified, the slump shall be 2 to 4 inches. If air entrainment is specified, the air content by volume shall be 5 to 8 percent of the volume of the concrete. When specified, directed and approved by the Engineer, a water-reducing, set-retarding or other admixture shall be used.

5. DESIGN OF THE CONCRETE MIX

The proportions of the aggregates shall be such as to produce a concrete mixture that will work readily into the corners and angles of the forms and around reinforcement when consolidated, but will not segregate or exude free water during consolidation.

Prior to placement of concrete, the Contractor shall furnish the Engineer, for approval, a statement of the materials and mix proportions (including admixtures, if any) he intends to use. The statement shall include evidence satisfactory to the Engineer that the materials and proportions will produce concrete conforming to this specification. The materials and proportions so stated shall constitute the "job mix." After a job mix has been approved, neither the source, character or grading of the aggregates nor the type or brand of cement or admixture shall be changed without prior notice to the Engineer. If such changes are necessary, no concrete containing such new or altered materials shall be placed until the Engineer has approved a revised job mix.

6. INSPECTION AND TESTING

The Engineer shall have free entry to the plant and equipment furnishing concrete under the contract. Proper facilities shall be provided for the Engineer to inspect materials, equipment and processes and to obtain samples of the concrete. All tests and inspections will be conducted so as not to interfere unnecessarily with manufacture and delivery of the concrete.

7. HANDLING AND MEASUREMENT OF MATERIALS

Materials shall be stockpiled and batched by methods that will prevent segregation or contamination of aggregates and insure accurate proportioning of the ingredients of the mix.

Except as otherwise provided in Section 8, cement and aggregates shall be measured as follows:

Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.

Water shall be measured, by volume or by weight, to an accuracy within one percent of the total quantity of water required for the batch.

Admixtures shall be measured within a limit of accuracy of three percent.

8. MIXERS AND MIXING

Concrete shall be uniform and thoroughly mixed when delivered to the work. Variations in slump of more than 1 inch within a batch will be considered evidence of inadequate mixing and shall be corrected by increasing mixing time or other means.

For stationary mixers, the mixing time after all cement and aggregates are in the mixer drum shall be not less than 1-1/2 minutes. When concrete is mixed in a truck mixer, the number of revolutions of the drum or blades at mixing speed shall be not less than 70 nor more than 100.

Unless otherwise specified, volumetric batching and continuous mixing at the construction site will be permitted if approved by the Contracting Officer. The batching and mixing equipment shall conform to the requirements of ASTM Specification C 685 and shall be demonstrated prior to placement of concrete, by tests with the job mix, to produce concrete meeting the specified proportioning and uniformity requirements. Concrete made by this method shall be produced, inspected, and certified in conformance with Sections 6, 7, 8, 13, and 14 of ASTM Specification C 685.

No mixing water in excess of the amount called for by the job mix shall be added to the concrete during mixing or hauling or after arrival at the delivery point.

9. FORMS

Forms shall be of wood, plywood, steel or other approved material and shall be mortar tight. The forms and associated falsework shall be substantial and unyielding and shall be constructed so that the finished concrete will conform to the specified dimensions and contours. Form surfaces shall be smooth and free from holes, dents, sags or other irregularities. Forms shall be coated with a nonstaining form oil before being set into place.

Metal ties or anchorages within the forms shall be equipped with cones, she-bolts or other devices that permit their removal to a depth of at least one inch without injury to the concrete. Ties designed to break off below the surface of the concrete shall not be used without cones.

All edges that will be exposed to view when the structure is completed shall be chamfered, unless finished with molding tools as specified in Section 18.

10. PREPARATION OF FORMS AND SUBGRADE

Prior to placement of concrete the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings and the temperature of all surfaces to be in contact with the new concrete shall be no colder than 40°F. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Rock surfaces shall be cleaned by air-water cutting, wet sandblasting or wire brush scrubbing, as necessary, and shall be wetted immediately prior to placement of concrete. Earth surfaces shall be firm and damp. Placement of concrete on mud, dried earth or uncompacted fill or frozen subgrade will not be permitted.

Items to be embedded in the concrete shall be positioned accurately and anchored firmly.

Weepholes in walls or slabs shall be formed with nonferrous materials.

11. CONVEYING

Concrete shall be delivered to the site and discharged into the forms within 1-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

The Engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the forms as rapidly as practicable by methods that will prevent segregation of the aggregates or loss of mortar.

12. PLACING

Concrete shall not be placed until the subgrade, forms and steel reinforcement have been inspected and approved. No concrete shall be placed except in the presence of the Engineer. The Contractor shall give reasonable notice to the Engineer each time he intends to place concrete. Such notice shall be far enough in advance to give the Engineer adequate time to inspect the subgrade, forms, steel reinforcement and other preparations for compliance with the specifications. "Other preparations" includes but is not limited to the concrete mixing plant, delivery equipment system, placing and finishing equipment and system, schedule of work, workforce, heating or cooling facilities if applicable. Deficiencies are to be corrected before concrete is delivered for placing.

The concrete shall be deposited as closely as possible to its final position in the forms and shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates or excessive laitance. Formed concrete shall be placed in horizontal layers not more than 20 inches thick. Concrete shall not be dropped more than five feet vertically unless suitable equipment is used to prevent segregation. Hoppers and chutes, pipes or "elephant trunks" shall be used as necessary to prevent segregation and the splashing of mortar on the forms and reinforcing steel above the layer of being placed.

Immediately after the concrete is placed in the forms, it shall be consolidated by spading, hand tamping or vibration as necessary to insure smooth surfaces and dense concrete. Each layer shall be consolidated to insure monolithic bond with the preceding layer. If the surface of a layer of concrete in place sets to the degree that it will not flow and merge with the succeeding layer when spaded or vibrated, the Contractor shall discontinue placing concrete and shall make a construction joint according to the procedure specified in Section 13.

If placing is discontinued when an incomplete horizontal layer is in place, the unfinished end of the layer shall be formed by a vertical bulkhead.

13. CONSTRUCTION JOINTS

Construction joints shall be made at the locations shown on the drawings. If construction joints are needed which are not shown on the drawings, they shall be placed in locations approved by the Engineer.

Where a feather edge would be produced at a construction joint, as in the top surface of a sloping wall, an insert form shall be used so that the resulting edge thickness on either side of the joint is not less than 6 inches.

In walls and columns, as each lift is completed, the top surfaces shall be immediately and carefully protected from any condition that might adversely affect the hardening of the concrete.

Steel tying and form construction adjacent to concrete in place shall not be started until the concrete has cured at least 12 hours. Before new concrete is deposited on or against concrete that has hardened, the forms shall be retightened. New concrete shall not be placed until the hardened concrete has cured at least 12 hours.

Surfaces of construction joints shall be cleaned of all unsatisfactory concrete, laitance, coatings or debris by washing and scrubbing with a wire brush or wire broom or by other means approved by the Engineer. The surfaces shall be kept moist for at least one hour prior to placement of the new concrete.

14. EXPANSION AND CONTRACTION JOINTS

Expansion and contraction joints shall be made only at locations shown on the drawings.

Exposed concrete edges at expansion and contraction joints shall be carefully tooled or chamfered, and the joints shall be free of mortar and concrete. Joint filler shall be left exposed for its full length with clean and true edges.

Preformed expansion joint filler shall be held firmly in the correct position as the concrete is placed.

When open joints are specified, they shall be constructed by the insertion and subsequent removal of a wooden strip, metal plate or other suitable template in such a manner that the corners of the concrete will not be chipped or broken. The edges of open joints shall be finished with an edging tool prior to removal of the joint strips.

15. WATERSTOPS

Waterstops shall be held firmly in the correct position as the concrete is placed. Joints in metal waterstops shall be soldered, brazed or welded. Joints in rubber or plastic waterstops shall be cemented, welded or vulcanized as recommended by the manufacturer.

16. REMOVAL OF FORMS

Forms shall not be removed without the approval of the Engineer. Forms shall be removed in such a way as to prevent damage to the concrete. Supports shall be removed in a manner that will permit the concrete to take the stresses due to its own weight uniformly and gradually.

17. FINISHING FORMED SURFACES

Immediately after the removal of the forms:

a. All fins and irregular projections shall be removed from exposed surfaces.

b. The holes produced on all surfaces by the removal of form ties, cone-bolts, and she-bolts shall be cleaned, wetted and filled with a dry-pack mortar consisting of one part portland cement, three parts sand that will pass a No. 16 sieve, and just sufficient water to produce a consistency such that the filling is at the point of becoming rubbery when the material is solidly packed.

18. FINISHING UNFORMED SURFACES

All exposed surfaces of the concrete shall be accurately screeded to grade and then float finished, unless specified otherwise.

Excessive floating or troweling of surfaces while the concrete is soft will not be permitted.

The addition of dry cement or water to the surface of the screeded concrete to expedite finishing will not be allowed.

Joints and edges on unformed surfaces that will be exposed to view shall be chamfered or finished with molding tools.

19. CURING

Concrete shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Wood forms left in place during the curing period shall be kept continuously wet. Formed surfaces shall be thoroughly wetted immediately after forms are removed and shall be kept wet until patching and repairs are completed. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

Concrete, except at construction joints, may be coated with an approved curing compound in lieu of continued application of moisture. The compound shall be sprayed on the moist concrete surfaces as soon as free water has disappeared, but shall not be applied to any surface until patching, repairs and finishing of that surface are completed. The compound shall be applied at a uniform rate of not less than one gallon per 150 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall be thoroughly mixed before applying and continuously agitated during application. Curing compound shall not be applied to surfaces requiring bond to subsequently placed concrete, such as construction joints, shear plates, reinforcing steel and other embedded items. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified above. Surfaces covered by the membrane shall not be trafficked unless protected from wear.

20. REMOVAL OR REPAIR

When concrete is honeycombed, damaged or otherwise defective, the Contractor shall remove and replace the structure or structural member containing the defective concrete or, where feasible, correct or repair the defective parts. The Engineer will determine the required extent of removal, replacement or repair. Prior to starting repair work the Contractor shall obtain the Engineer's approval of his plan for effecting the repair. The Contractor shall perform all repair work in the presence of the Engineer.

21. CONCRETING IN COLD WEATHER

Concrete shall not be mixed nor placed when the daily minimum atmospheric temperature is less than 40°F unless facilities are provided to prevent the concrete from freezing. The use of accelerators or antifreeze compounds will not be allowed.

22. CONCRETING IN HOT WEATHER

The Contractor shall apply effective means to maintain the temperature of the concrete below 90°F during mixing, conveying and placing.

23. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, concrete will be measured to the neat lines shown on the drawings and the volume of concrete will be computed to the nearest 0.1 cubic yard. Measurement of concrete placed against the sides of an excavation without the use of intervening forms will be made only to the neat lines or pay limits shown on the drawings. No deduction in volume will be made for chamfers, rounded or beveled edges or for any void or embedded item that is less than 3 cubic feet in volume.

Payment for each item of concrete for minor structures will be made at the contract unit price or the contract lump sum, whichever is applicable, for that item. Such payment will constitute full compensation for all labor, materials, equipment, transportation, tools, forms, falsework, bracing and all other items necessary and incidental to the completion of the work, except items listed for payment elsewhere in the contract.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 24 of this specification.

24. ITEM OF WORK AND CONSTRUCTION DETAILS

Item of work to be performed in conformance with this specification and the construction details are:

a. Subsidiary Item, Concrete

(1) This item shall consist of all concrete as required to build the concrete footings for Bid Item 13, Metal Plates, and Bid Item 17, 18-Inch CMP.

(2) In Section 2, Materials, the maximum aggregate size for concrete shall be 3/4 inch.

(3) In Section 4, Air Content and Consistency, the concrete shall be air entrained. Air Entraining Admixtures shall conform to the requirements of Material Specification 532. A water reducing or water reducing and set retarding admixture, conforming to Material Specification 533, may be used at the option of the Contractor.

(4) In Section 23, Measurement and Payment, will not apply. Compensation for concrete will be included in Bid Item 13, Metal Plates or Bid Item 17, 18-Inch CMP as appropriate. No separate payment for concrete will be made.

CONSTRUCTION SPECIFICATION

51. CORRUGATED METAL PIPE CONDUITS

1. SCOPE

The work shall consist of furnishing and placing circular, arched or elliptical corrugated metal pipe and the necessary fittings.

2. MATERIALS

Pipe and fittings shall conform to the requirements of Material Specification 551 or Material Specification 552, whichever is specified.

3. LAYING AND BEDDING THE PIPE

Unless otherwise specified, the pipe shall be installed in accordance with the manufacturer's recommendations. The pipe shall be laid with the outside laps of circumferential joints pointing upstream and with longitudinal laps at the sides at about the vertical midheight of the pipe. Field welding of corrugated galvanized iron or steel pipe will not be permitted. Unless otherwise specified, the pipe sections shall be joined with standard coupling bands. The pipe shall be firmly and uniformly bedded throughout its entire length to the depth and in the manner specified on the drawings.

Perforated pipe shall be laid with the perforations down and oriented symmetrically about a vertical center line. Perforations shall be clear of any obstructions at the time the pipe is laid.

The pipe shall be loaded sufficiently during backfilling around the sides to prevent its being lifted from the bedding.

4. STRUTTING

When required, struts or horizontal ties shall be installed in the manner specified on the drawings. Struts and ties shall remain in place until the backfill has been placed to a height of 5 feet above the top of the pipe, or has been completed if the finished height is less than 5 feet above the top of the pipe, at which time they shall be removed by the Contractor.

5. HANDLING THE PIPE

The Contractor shall furnish such equipment as is necessary to place the pipe without damaging the pipe or coatings. The pipe shall be transported and handled in such a manner as to prevent bruising, scaling, or breaking of the spelter coating or bituminous coating.

6. REPAIR OF DAMAGED COATINGS

Any damage to the zinc coating shall be repaired by thoroughly wire brushing the damaged area, removing all loose and cracked coating, removing all dirt and greasy material with solvent, and painting with two coats of zinc dust-zinc oxide primer conforming to the requirements of Federal Specification TT-P-641, Type III, or zinc dust paint conforming to the requirements of Military Specification MIL-P-21035. If the coating is damaged in any individual area larger than 12 square inches, or if more than 0.2 percent of a total surface area of a length of pipe is damaged, the length will be rejected.

Breaks or scuffs in bituminous coatings that are less than 36 square inches in area shall be repaired by the application of two coats of hot asphaltic paint or a coating of cold-applied bituminous mastic. The repair coating shall be at least 0.05 inches thick after hardening and shall bond securely and permanently to the pipe. The material shall meet the physical requirements for bituminous coatings contained in the references cited in Material Specifications 551 and 552. Whenever individual breaks exceed 36 square inches in area or when the total area of breaks exceeds 0.5 percent of the total surface area of the pipe, the pipe will be rejected.

Bituminous coating damaged by welding of coated pipe or pipe fittings shall be repaired as specified in this Section for breaks and scuffs in bituminous coatings.

7. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract the quantity of each type, class, size and gauge of pipe will be determined to the nearest 0.1 foot by measurement of the laid length of pipe along the centerline of the pipe. Payment for each type, class, size and gauge of pipe will be made at the contract unit price for that type, class, size and gauge of pipe. Such payment will constitute full compensation for furnishing, transporting and installing the pipe and fittings and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 8 of this specification.

8. ITEM OF WORK AND CONSTRUCTION DETAILS

Item of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 17, 18-Inch CMP

(1) This side Drains item shall consist of furnishing and installing the 18-inch CMP as shown on the drawings, including the metal plate cover and the concrete outlet.

(2) In Section 2, Materials, pipe and fittings shall conform to Material Specification 551 and Federal Specification WW-P-405B for Class I or II, Shape 1 corrugated steel pipe.

Base metal shall be 16 gage, (0.064-inch) minimum copper steel.

(3) In Section 3, Laying and Bedding the Pipe, the CMP shall have watertight joints.

(4) In Section 7, Measurement and Payment, payment for Bid Item 17, 18-Inch CMP, will include full compensation for the concrete necessary to build the concrete outlet aprons for the side Drains.

CONSTRUCTION SPECIFICATION

61. LOOSE ROCK RIPRAP

1. SCOPE

The work shall consist of the construction of loose rock riprap revetments and blankets, including filter layers or bedding where specified.

2. MATERIALS

Rock for loose rock riprap shall conform to the requirements of Material Specification 523 or, if so specified shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines and other materials not meeting the required gradation limits.

At least 30 days prior to delivery of rock from other than designated sources, the Contractor shall designate in writing the source from which he intends to obtain the rock and information satisfactory to the Contracting Officer that the material meets the requirements of the contract. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in Section 9 of this specification.

Rock from designated sources shall be excavated, selected and processed as necessary to meet the quality and grading requirements in Section 9 of this specification. The rock shall conform to the specified grading limits when installed in the riprap.

Filter or bedding materials when required, shall, unless otherwise specified, conform to the requirements of Material Specification 521.

3. SUBGRADE PREPARATION

The subgrade surfaces on which the riprap or bedding course is to be placed shall be cut or filled and graded to the lines and grades shown on the drawings. When fill to subgrade lines is required, it shall consist of approved materials and shall conform to the requirements of the specified class of fill.

Riprap shall not be placed until the foundation preparation is completed and the subgrade surfaces have been inspected and approved by the Engineer.

4. EQUIPMENT-PLACED ROCK RIPRAP

The rock shall be placed by equipment on the surfaces and to the depths specified. The riprap shall be constructed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying materials. The rock shall be delivered and placed in a manner that will insure that the riprap in place shall be reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks.

Riprap shall be placed in a manner to prevent damage to structures. Hand placing will be required to the extent necessary to prevent damage to the permanent works.

5. HAND-PLACED RIPRAP

The rock shall be placed by hand on the surfaces and to the depths specified. It shall be securely bedded with the larger rocks firmly in contact one to another. Spaces between the larger rocks shall be filled with smaller rocks and spalls. Smaller rocks shall not be grouped as a substitute for larger rock. Flat slab rock shall be laid on edge.

6. FILTER LAYERS OR BEDDING

When the drawings specify filter layers or bedding beneath riprap, the filter or bedding material shall be spread uniformly on the prepared subgrade surfaces to the depth specified. Compaction of filter layers or bedding will not be required, but the surface of such layers shall be finished reasonably free of mounds, dips or windrows.

7. TESTING

The Engineer will perform such tests as are required to verify that the riprap, filter, and bedding materials and the completed work meet the requirements of the specifications. These tests are not intended to provide the Contractor with the information he needs to assure that the materials and workmanship meet the requirements of the specifications, and their performance will not relieve the Contractor of the responsibility of performing his own tests for that purpose.

8. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the quantity of each type of riprap placed within the specified limits will be measured to the nearest ton by actual weight, and the volume of each type of filter layer or bedding will be measured within the specified limits and computed to the nearest cubic year by the method of average cross-sectional end areas. For each load of rock placed as specified, the Contractor shall furnish to the Engineer a statement-of-delivery ticket showing the weight, to the nearest 0.1 ton, of rock in the load.

Payment for each type of riprap will be made at the contract unit price for that type of riprap. Payment for each type of filter or bedding will be made at the contract unit price for that type of filter or bedding. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap, filter layers and bedding.

The following provisions apply to all methods of measurement and payment. Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 9 of this specification.

9. ITEM OF WORK AND CONSTRUCTION DETAILS

Item of work to be performed in conformance with this specification and the construction details is:

a. Bid Item 10, Loose Rock Riprap

(1) This item shall consist of furnishing and placing loose rock riprap, including boulders, at the locations as shown on the drawings.

(2) In Section 2, Materials, rock for loose rock riprap shall meet the following gradation requirements:

Average Diameter Inches	Percent Larger Than
24	0
18	10 - 50
12	30 - 70
6	60 - 85
3	95 - 100
BOULDERS 4-5 feet minimum average diameter	

Riprap shall be earth tone, dark grey or brown in color, as approved by the Engineer.

Control of gradation will be by visual inspection. The Contractor shall provide two samples of rock, of at least 10 tons each, meeting the specified gradation. One sample shall be placed at the construction site and may become part of the finished riprap section.

The other sample shall be provided at the quarry. These samples shall be used as a frequent reference for judging the gradation of the riprap supplied. Any difference of opinion between the Engineer and the Contractor shall be resolved by dumping and checking the gradation of two random truckloads of rock. Mechanical equipment, a sorting site, and labor needed to assist in checking gradation shall be provided by the Contractor at his expense.

(3) In Section 4, Equipment - Placed Rock Riprap, the rock shall be placed to result in a reasonably uniform riprap layer not less than the thickness shown on the drawings, with the larger rocks well distributed and the voids between the larger rocks filled with smaller rocks.

(4) The tolerance for placing rock riprap will be a minus 3 inches to a plus 8 inches from the exterior neat lines indicated on the drawings, except that 20 to 40 percent of the rocks shall extend 12 inches above the neat lines. The extreme minus tolerance shall not be continuous over an area exceeding 25 square feet.

CONSTRUCTION SPECIFICATION

62. GROUTED ROCK RIPRAP

1. SCOPE

The work shall consist of furnishing, transporting, and placing rock and concrete grout in the construction of grouted rock riprap sections.

2. MATERIALS

Rock for grouted rock riprap shall conform to the requirements of Material Specification 523, or if so specified shall be obtained from designated sources. It shall be free from dirt, clay, sand, rock fines, and other materials not meeting the required gradation limits.

At least 30 days prior to delivery of rock from other than designated sources, the Contractor shall designate, in writing, the source from which he intends to obtain the rock and information satisfactory to the Contracting Office that the material meets the requirements of the contract. The Contractor shall provide the Engineer free access to the source for the purpose of obtaining samples for testing. The size and grading of the rock shall be as specified in Section 13 of this specification.

Rock from designated sources shall be excavated, selected and processed as necessary to meet the quality and grading requirements in Section 13 of this specification. The rock shall conform to the specified grading limits when installed in the riprap.

Filter or bedding materials when required, shall unless otherwise specified, conform to the requirements of Material Specification 521.

Portland cement shall conform to the requirements of Material Specification 531 for the specified type.

Pozzolan. Unless otherwise specified in Section 13 of this specification, pozzolans conforming to Specification ASTM C-618 class F in amounts not to exceed 20 percent, based on absolute volume, may be substituted for an equivalent amount of portland cement in the grout mixture.

Aggregates shall conform to the requirements of Material Specification 522, except that the grading for coarse aggregate shall be as specified in the construction details.

Water shall be clean and free from injurious amounts of oils, acid, alkali, organic matter or other deleterious substances.

Air-entraining admixtures shall conform to the requirements of Material Specification 532.

Curing compound shall conform to the requirements of Material Specification 534.

Other admixtures, when required, shall be as specified in the construction details.

3. SUBGRADE PREPARATION

Riprap or filter shall not be placed until the subgrade surfaces have been inspected and approved by the Engineer.

4. FILTER LAYERS OR BEDDING

When filter layers or bedding beneath the riprap is specified, the material shall be spread uniformly on the prepared subgrade surfaces to the depth shown on the drawings. Compaction of the material will not be required but the surfaces of such layers shall be finished reasonably free of mounds, dips, or windrows.

5. PLACING ROCK

The rock shall be placed on the surfaces and to the depths specified in such a manner as to avoid displacement of the underlying materials. The rock may be equipment or hand placed as necessary to produce a surface in which the tops of the individual rocks do not vary more than the specified deviation from the neat lines shown on the drawings. Double decking of thin, flat rocks to bring the surface up to the required grade will not be permitted.

6. DESIGN OF THE GROUT MIX

The mix proportions for the grout mix shall be as specified in the construction details. During the course of the work the Engineer will require adjustment of the mix proportions whenever necessary. After the mix has been designated, it shall not be changed without the approval of the Engineer.

7. HANDLING AND MEASUREMENT OF MATERIAL

Materials shall be stockpiled and batched by methods that will prevent segregation or contamination of aggregates and insure accurate proportioning of the ingredients of the mix.

Except as otherwise provided in Section 11, cement and aggregates shall be measured as follows:

Cement shall be measured by weight or in bags of 94 pounds each. When cement is measured in bags, no fraction of a bag shall be used unless weighed.

Aggregates shall be measured by weight. Mix proportions shall be based on saturated, surface-dry weights. The batch weight of each aggregate shall be the required saturated, surface-dry weight plus the weight of surface moisture it contains.

Water shall be measured, by volume or by weight, to an accuracy within one percent of the total quantity of water required for the batch.

Admixtures shall be measured within a limit of accuracy of ±3 percent.

8. MIXERS AND MIXING

The mixer, when loaded to capacity, shall be capable of combining the ingredients of the grout mix into a thoroughly mixed and uniform mass and of discharging it with a satisfactory degree of uniformity.

Mixer shall be operated within the limits of the manufacturer's guaranteed capacity and speed of rotation.

The time of mixing after all cement and aggregates are in the mixer drum shall be not less than one minute for mixers having a capacity of one cubic yard or less. For mixers of larger capacities, the minimum time shall be increased fifteen seconds for each cubic yard or fraction thereof of additional capacity. The batch shall be so charged into the mixer that some water will enter in advance of cement and aggregate, and all mixing water shall be introduced into the drum before one-fourth of the mixing time has elapsed.

When ready-mixed grout mix is furnished, the Contractor shall furnish to the Engineer a delivery ticket showing the time of loading and the quantities of materials used for each load of grout mix.

No mixing water in excess of the amount called for by the job mix shall be added to the grout mix during mixing or hauling or after arrival at the delivery point.

9. CONVEYING AND PLACING

The grout mix shall be delivered to the site and placed within 1-1/2 hours after the introduction of the cement to the aggregates. In hot weather or under conditions contributing to quick stiffening of the concrete, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. The Engineer may allow a longer time, provided the setting time of the concrete is increased a corresponding amount by the addition of an approved set-retarding admixture. In any case, concrete shall be conveyed from the mixer to the final placement as rapidly as practicable by methods that will prevent segregation of the aggregates or loss of mortar.

Grout mix shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation.

The grout mix shall not be placed until the rock riprap has been inspected and approved by the Engineer.

Rock to be grouted shall be kept wet for at least 2 hours immediately prior to grouting.

The rock riprap shall be flushed with water to remove the fines from the rock prior to placing the grout. The rock shall be kept moist just ahead of the actual placing, but the grout shall not be placed in standing or flowing water. Grout placed on inverts or other nearly level areas may be placed in one course. On slopes, the grout shall be placed in two (2) courses in successive lateral strips approximately ten (10) feet in width starting at the toe of the slope and progressing to the top. The grout shall be delivered to the place of final deposit by approved means and discharged directly on the surface of the rock, using a splash plate of metal or wood to prevent displacement of the rock directly under the discharge. The flow of grout shall be directed with brooms, spades or baffles to prevent it from flowing excessively along the same path and to assure that all intermittent spaces are filled. Sufficient barring shall be done to loosen tight pockets of rock and otherwise aid the penetration of grout so that all voids shall be filled and the grout fully penetrates the rock blanket. All brooming on slopes shall be uphill and after the grout has stiffened, the entire surface shall be rebroomed to eliminate runs and to fill voids caused by sloughing.

After completion of any strip or panel, no workman or other load shall be permitted on the grouted surface for a period of twenty-four (24) hours. The grouted surface shall be protected from injurious action by the sun, rain, flowing water and mechanical injury.

10. CURING AND PROTECTION

The surface of treatment materials shall be prevented from drying for a curing period of at least 7 days after it is placed. Exposed surfaces shall be kept continuously moist for the entire period, or until curing compound is applied as specified below. Moisture shall be maintained by sprinkling, flooding or fog spraying or by covering with continuously moistened canvas, cloth mats, straw, sand or other approved material. Water or covering shall be applied in such a way that the concrete surface is not eroded or otherwise damaged.

The grouted rock may be coated with an approved curing compound in lieu of continued application of moisture. The compound shall be sprayed on the moist concrete surfaces as soon as free water has disappeared, but shall not be applied to any surface until finishing of that surface is completed. The compound shall be applied at a uniform rate of not less than one gallon per 150 square feet of surface and shall form a continuous adherent membrane over the entire surface. Curing compound shall not be applied to surfaces requiring bond to subsequently placed concrete. If the membrane is damaged during the curing period, the damaged area shall be resprayed at the rate of application specified above.

Grout mix shall not be placed when the daily minimum temperature is less than 40°F unless facilities are provided to insure that the temperature of the materials is maintained at not less than 50°F nor more than 90°F during placement and the curing period. Grout mix shall not be placed on frozen surfaces. When freezing conditions prevail, rock to be grouted must be covered and heated to a range of 50°F to 90°F for at least 24 hours prior to placing treatment materials.

11. INSPECTING AND TESTING FRESH GROUT

The Engineer will inspect and test grout during the course of the work. Sampling of fresh grout will be done by the methods prescribed in ASTM Designation C 172. The volume of each batch will be determined by the methods prescribed in ASTM Designation C 138.

The Engineer shall have free entry to all parts of the Contractor's plant and equipment which concern mixing and placing the grout while work on the contract is being performed. Proper facilities shall be provided for the Engineer to inspect materials and processes used in mixing and placing the grout as well as for securing samples of the grout mix. All tests and inspections shall be so conducted as not to interfere unnecessarily with the mixing and placing of the grout.

When ready-mixed grout is furnished, the Contractor shall furnish to the Engineer a statement-of-delivery ticket for each batch delivered to the job site. The ticket shall show the total weights in pounds of cement, water, and fine and coarse aggregates, amount of air-entraining agent, time of loading, and the revolution counter reading at the time of batching.

12. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the volume of riprap and the volume of filter layers or bedding will be determined from the specified thickness shown on the drawings and the area on which acceptable placement has been made. The volume of grout will be determined from the calculated batch volume and the number of mixed batches delivered to the site and acceptably placed in the work. Payment for riprap; filter or bedding material; and the concrete grout will be made at the contract unit price for each item. Such payment will be considered full compensation for all labor, materials, equipment, and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 13 of this specification.

13. ITEM OF WORK AND CONSTRUCTION DETAILS

Item of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 11, Grouted Rock Riprap

(1) This item shall consist of the grouted rock riprap including the boulders as shown on the drawings.

(2) In Section 2, Materials, rock for grouted rock riprap shall meet the following gradation requirements:

Average Diameter Inches	Percent Larger Than
36	0 - 5
24	20 - 50
12	50 - 80
8	60 - 85
6	95 - 100

Riprap shall be earth tone, dark grey or brown in color, as approved by the Engineer.

Some additional rock for individual placement of boulders, with 48-inch to 60-inch average diameters, shall be furnished for placement as shown in the drawings.

Dirty rock shall be washed at a location away from the worksite.

Control of gradation will be by visual inspection. The Contractor shall provide two samples of rock, of at least 10 tons each, meeting the specified gradation. One sample shall be placed at the construction site and may become part of the finished riprap section.

The other sample shall be provided at the quarry. These samples shall be used as a frequent reference for judging the gradation of the riprap supplied. Any difference of opinion between the Engineer and the Contractor shall be resolved by dumping and checking the gradation of two random truckloads of rock. Mechanical equipment, a sorting site, and labor needed to assist in checking gradation shall be provided by the Contractor at his expense.

(3) In Section 5, Placing Rock:

(a) Individual boulders with average diameters from 48 inches to 60 inches, shall be placed at the locations shown on the drawings and as directed by the Engineer.

(b) The long axis of each individual boulder shall be placed vertical with a minimum of two-thirds of the diameter projecting above the neat lines of the grouted rock riprap. The boulders shall be placed such that adequate anchorage is assured.

(c) The rock shall be placed to result in a reasonably uniform riprap layer not less than the thickness shown on the drawings, with the larger rocks well distributed and the voids between the larger rocks filled with smaller rocks.

(d) The tolerance for placing rock riprap shall be a minus 3 inches to a plus 8 inches from the exterior neat lines indicated on the drawings, except that 20 to 40 percent of the rocks shall extend 12 inches above the neat lines. The extreme minus tolerance will not be continuous over an area exceeding 25 square feet.

(e) In Section 12, Measurement and Payment is changed as follows. For items of work for which specific unit prices are established in the contract, the quantity of each type of riprap placed within the specified limits will be measured to the nearest ton by actual weight. For each load of rock placed as specified, the Contractor shall furnish to the Engineer a statement-of-delivery ticket showing the weight, to the nearest 0.1 ton, of rock in the load.

Payment for each type of riprap will be made at the contract unit price for that type of riprap. Such payment will be considered full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the riprap.

b. Bid Items 12, Grout

(1) This item shall consist of grout, weepholes and stainless steel hardware cloth for the grouted rock riprap as shown on the drawings and as specified herein.

(2) In Section 6, Design of Grout Mix, the concrete mix for grout shall contain Type D, Water Reducing and Retarding admixture conforming to Material Specification 533, and shall contain not less than 6 sacks of cement per cubic yard of concrete. Cement shall be Type II portland cement. The maximum size of coarse aggregate shall be 3/8 inch.

The slump shall be 6 to 8 inches.

(3) Weepholes shall be 2½-inch I.D., PVC Schedule 40 pipe. Weep holes shall be placed on a 20 foot grid through all level grouted rock sections. On sloped sections weep holes shall be placed at 10 foot centers, 1.0 foot above the toe of the slope or as shown on the drawings.

Weep holes through level grouted rock areas and as shown on the drawings shall be filled with bedding material.

All weepholes shall have an 8x8 mesh (.035 inch maximum wire diameter) stainless steel wire cloth securely attached, with a nine gage copper wire through holes in the pipe, over the rear opening of each weephole.

(4) In Section 9, Conveying and Placing, paragraphs 2 and 5 are hereby deleted. The rock riprap shall be washed with water to remove dirt from the rock surfaces prior to placing the grout. The rock shall be kept moist just ahead of the actual placing, but the grout shall not be placed in standing water. Grout placed on inverts or other nearly level areas may be placed in one course. On slopes, the grout shall be placed in successive lateral strips approximately 10 feet inwidth starting at the toe and progressing to the top of the slope. The grout shall be delivered to the place of final deposit by a concrete pump, at a rate approved by the Engineer, and discharged directly into the voids of the rock blanket. Grout shall not be discharged more than 3-feet vertically from delivery hose outlet. A broom, a shovel or a splash plate shall be used to prevent displacement of the rock directly under the discharge. The flow of the grout shall be directed with brooms, spades or baffles to prevent it from dislodging rocks from the slopes or from flowing excessively along the same path and to assure that all intermittent spaces are filled. Sufficient barring shall be done to loosen tight pockets of rock and otherwise aid the penetration of grout so that all voids shall be filled and grout fully penetrates the rock blanket. Brooming shall proceed immediately following and in conjunction with the grout placement. The entire surface shall be broomed to eliminate runs, footprints, hose marks or other marks caused during placement and to fill voids caused by sloughing. Brooming shall not leave a smooth surface but shall leave approximately one-third of the topmost layer of rocks and those rocks extending above the neat line protruding from the grout. Care shall be made not to splash grout onto the exposed surfaces of the individual boulders. Any grout that is inadvertently slashed onto the boulders shall be broomed off.

(5) In Section 10, Curing and Protection, the curing compound shall be Type 1-D, clear or translucent with a fugitive dye to aid checking coverage.

(6) Section 12, Measurement and Payment, for grout will be at the contract unit price per cubic yard. Compensation for the weep holes, filter material for the weepholes and the 8x8 mesh stainless steel wire cloth will be included in Bid Item 12, Grout. No separate payment will be made for these items.

CONSTRUCTION SPECIFICATION

81. METAL FABRICATION AND INSTALLATION

1. SCOPE

The work shall consist of furnishing, fabricating and erecting metalwork, including the metal parts of composite structures.

2. MATERIALS

Unless otherwise specified, materials shall conform to the requirements of Material Specification 581. Steel shall be structural quality unless otherwise specified. Castings shall be thoroughly cleaned and subjected to careful inspection before installation. Finished surfaces shall be smooth and true to assure proper fit. Galvanizing shall conform to the requirements of Material Specification 582.

3. FABRICATION

Fabrication of structural steel shall conform to the requirements of Section 1.23 of the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings (Riveted, Bolted and Arc-Welded Construction)," American Institute of Steel Construction.

Fabrication of structural aluminum shall conform to the requirements in the Aluminum Construction Manual, "Specifications for Aluminum Structures," Section 6 and Section 7, The Aluminum Association, November 1976.

4. ERECTION

The frame of metal structures shall be carried up true and plumb. Temporary bracing shall be placed wherever necessary to resist all loads to which the structure may be subjected, including those applied by the installation and operation of equipment. Such bracing shall be left in place as long as may be necessary for safety.

As erection progresses the work shall be securely bolted up, or welded, to resist all dead load, wind and erection stresses. The Contractor shall furnish such fitting up bolts, nuts and washers as may be required.

No riveting or welding shall be done until as much of the structure as will be stiffened thereby has been properly aligned.

Rivets driven in the field shall be heated and driven with the same care as those driven in the shop.

All field welding shall be done in conformance to the requirements for shop fabrication, except those that expressly apply to shop conditions only.

Galvanized items shall not be cut, welded or drilled after the zinc coating is applied.

5. PROTECTIVE COATINGS

Items specified to be galvanized shall be completely fabricated for field assembly before the application of the zinc coatings.

Items specified to be painted shall be painted in conformance to the requirements of Construction Specification 82 for the specified paint systems.

6. MEASUREMENT AND PAYMENT

The work will not be measured. Payment for furnishing, fabricating and installing each item of metalwork will be made at the contract price for that item. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to the completion of the work, including connectors and appurtenances such as rivets, bolts, nuts, pins, studs, washers, hangers and weld metal.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 7 of this specification.

7. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 13, Metal Plates

(1) This item shall consist of the metal plates in the fish ladders as shown on the drawings.

(2) In Section 2, Materials, the metal plates shall conform to the requirements of ASTM A242 or A588.

Concrete shall conform to the requirements of Specification 32. Concrete for Minor Structures.

(3) The metal plates shall not be painted, galvanized or otherwise coated.

(4) The metal plates shall be set vertical and perpendicular to the channel and securely set in the concrete footings prior to placement of the rock.

(5) In Section 6, Measurement and Payment, payment for Bid Item 13, Metal Plates, will include full compensation for the concrete necessary to build the concrete footings for the metal plates.

CONSTRUCTION SPECIFICATION

400. WILLOW CUTTINGS

1. SCOPE

This work shall consist of preparing the area for treatment, furnishing and planting the willow cuttings in the areas specified herein and as shown on the drawings.

2. MATERIALS

Cuttings--Willow cuttings shall be made from healthy green plants.

Cuts shall be made clean with sharp tools. The butt end of the stem shall be a slant cut and the tip end shall be cut square-across the stem. All leaves shall be removed immediately after the cutting has been taken.

The diameter of the cutting shall not be more than 2 inches at the butt end or smaller than ¼ inch at the tip.

The length of the cuttings shall be as follows:

a. Deep plantings made 3-feet deep shall have a minimum cutting length of 4 feet and a maximum length of 5 feet.

b. Plantings made in soils moist throughout the year shall have a minimum cutting length of 2½ feet and a maximum length of 3½ feet.

Cuttings shall not be allowed to dry and shall be no more than 5 days old when planted. If the cuttings are not planted the same day they are cut, the method of keeping cuttings moist shall be approved by the Engineer.

No cutting shall be taken from sites or sources without the approval of the Engineer.

3. PLANT TYPES

The woody cuttings shall be willow (Salix sp.).

4. PLANTING REQUIREMENTS

Planting shall not begin until approval is given by the Engineer.

Willow cuttings shall be planted in a single row. Plantings shall be spaced 3 feet apart in the row.

Cuttings shall be planted in prepared holes or "V" furrows to avoid stripping the bark, especially in rocky or hard soils. Cutting may be pushed into soil if the soil is saturated. This determination will be made by the Engineer in the field.

Cuttings shall be placed in the soil with the butt end in a downward position.

All cuttings shall have 6 inches to a maximum of 1 foot of at least 2 nodes above the ground level. The exposed tip of each cutting shall be sealed with a tar compound suitable for treating pruning cuts on fruit trees.

Plantings shall be placed into the soil to a depth of a least 3 feet. If however, due to some physical condition of the soil this planting depth cannot be attained, the cuttings shall be set with 3/4 of its length in the ground upon approval of the Engineer. Plantings shall be protected from damage and soil kept moist in the lower two feet of the planting depth for the duration of the contract.

5. MEASUREMENT AND PAYMENT

For items of work for which specific unit prices are established in the contract, the length of each row, along the centerline of the channel will be measured to the nearest foot. Such payment will include full payment for all labor, materials and equipment, and all other items necessary and incidental to the completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the items to which they are made subsidiary are identified in Section 6 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 15, Willow Cuttings

(1) This item shall consist of the single row of willow cuttings at the toe of the loose rock riprap as shown on the drawings.

CONSTRUCTION SPECIFICATION

402. PUBLIC SAFETY

1. SCOPE

The work shall consist of providing for public safety and maintaining traffic control.

2. TRAFFIC AND ACCESS

The Contractor's operations shall cause no unnecessary inconvenience to the public. The access rights of the public shall be considered at all times. Unless otherwise authorized, traffic shall be permitted to pass through the work on approved or specified detours.

3. STORAGE OF EQUIPMENT AND MATERIALS IN PUBLIC STREETS

Construction materials may not be stored in streets, roads or highways. All such materials or equipment not installed or used in the construction shall be stored elsewhere by the Contractor at his expense.

4. SIGNS, LIGHTS, AND DEVICES

All signs, lights, barricades, and use of flagmen shall conform to the current requirements set forth in the current "Manual of Warning Signs, Lights, and Devices for Use in Performance of Work upon Highways," issued by the State of California, Business and Transportation Agency, Department of Transportation and any local requirements by the city of Gilroy or the Santa Clara Valley Water District.

5. MEASUREMENT AND PAYMENT

For items of work for which specific lump sum prices are established in the contract, payment for the work will be made at the contract lump sum price. Such payment will constitute full compensation for all labor, materials, equipment and all other items necessary and incidental to completion of the work.

Compensation for any item of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and the item to which they are made subsidiary are identified in Section 6 of this specification.

6. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in conformance with this specification and the construction details are:

a. Bid Item 16, Public Safety

(1) This item includes furnishing, installing and maintaining all access to adjacent property; all barricades, signs, warnings, lighting, striping and flagmen necessary to control and protect all traffic, pedestrians and cyclists from the work and of complying with permits or any other public convenience and safety work which is not specifically covered by any other items of work.

(2) The contractor shall meet the requirements of all agencies having jurisdiction in traffic control including the California Department of Transportation, the City of Gilroy and the Santa Clara Valley Water District.

(3) All traffic controls shall be provided with adequate warning light during hours of darkness.

(4) In Section 5, Measurement and Payment, compensation for complying with the permits will be included in Bid Item 16, Public Safety. No separate payment will be made for this item.

CONTRACT MATERIAL SPECIFICATIONS

MATERIAL SPECIFICATION

521. AGGREGATES FOR DRAINFILL AND FILTERS

1. SCOPE

This specification covers the quality of mineral aggregates for the construction of drainfill and filters.

2. QUALITY

Drainfill and filter aggregates shall be sand, gravel or crushed stone or mixtures thereof. They shall be composed of clean, hard, durable mineral particles free from organic matter, clayballs, soft particles or other substances that would interfere with their free-draining properties.

Aggregates of crushed limbstone shall be thoroughly washed and screened. Course aggregate containing crushed limestone shall have not more than 3 percent by weight of particles finer than the No. 4 sieve. Crushed limestone shall not be used for fine aggregates except in combination with other materials such that not more than 5 percent of the portion finer than the No. 4 sieve shall be crushed limestone.

Aggregates shall be tested for soundness according to ASTM Method C 88, and shall have a weighted average loss in five cycles of not more than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

3. GRADING

Drainfill and filter aggregates shall conform to the specified grading limits after being placed in the work, and after being compacted if compaction is specified. Grading shall be determined by ASTM Method C 136.

4. STORING AND HANDLING

Drainfill and filter aggregates shall be stored and handled by methods that prevent segregation of particle sizes or contamination by mixing with other materials.

MATERIAL SPECIFICATION

522. AGGREGATE FOR PORTLAND CEMENT CONCRETE

1. SCOPE

This specification covers the quality of fine aggregate and coarse aggregate for use in the manufacture of portland cement concrete.

2. QUALITY

Aggregate shall conform to the requirements of ASTM Specification C-33 for the specified sizes. Aggregates that fail to meet any requirement may be accepted only when: (1) the specified alternate conditions of acceptance can be proved prior to the use of the aggregates on the job and within a period of time such that no work under the contract will be delayed by the requirements of such proof; or, (2) the specification for concrete expressly contains a provision of special mix requirements to compensate for the effects of the deficiencies.

3. REACTIVITY WITH ALKALIES

The potential reactivitiy of aggregates with the alkalies in cement shall be evaluated by petrographic examination and, where applicable, the chemical method of test, ASTM Designation C 289, or by the results of previous tests or service records of concrete made from similar aggregates from the same source. The standards for evaluating potential reactivity shall be as described in ASTM Specification C 33, Appendix A1.

Aggregates indicated by any of the above to be potentially reactive shall not be used, except under one of the following conditions:

a. Applicable test results of mortar bar tests, made according to ASTM Method C 227, are available which indicate an expansion of less than 0.10 percent at six months in mortar bars made with cement containing not less than 0.8 percent alkalies expressed as sodium oxide; or

b. Concrete made from similar aggregates from the same source has been demonstrated to be sound after 3 years or more of service under conditions of exposure to moisture and weather similar to those anticipated for the concrete under these specifications.

Aggregates indicated to be potentially reactive, but within acceptable limits as determined by mortar bar test results or service records, shall be used only with "low alkali" cement, containing less than 0.60 percent alkalies expressed as sodium oxide.

4. STORING AND HANDLING

Aggregate of each class and size shall be stored and handled by methods that prevent segregation of particles sizes or contamination by intermixing with other materials.

MATERIAL SPECIFICATION

523. ROCK FOR RIPRAP

1. SCOPE

This specification covers the quality of rock to be used in the construction of rock riprap.

2. QUALITY

Individual rock fragments shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. The rock fragments shall be angular to subrounded in shape. The least dimension of an individual rock fragment shall be not less than one-third the greatest dimension of the fragment.

Except as provided below, the rock shall have the following properties:

a. Bulk specific gravity (saturated surface-dry basis) not less than 2.5.

b. Absorption not more than 2 percent.

c. Soundness: Weight loss in 5 cycles not more than 10 percent when sodium sulfate is used or 15 percent when magnesium sulfate is used.

The bulk specific gravity and absorption shall be determined by ASTM Method C 127. The test for soundness shall be performed by ASTM Method C 88 for coarse aggregate modified as follows:

The test sample shall not be separated into fractions. It shall consist of 5000 ± 300 grams of rock fragments, reasonably uniform in size and shape and weighing approximately 100 grams each, obtained by breaking the rock and selecting fragments of the required size.

After the sample has been dried, following completion of the final test cycle and washing to remove the sodium sulfate or magnesium sulfate, the loss of weight shall be determined by subtracting from the original weight of the sample the final weight of all fragments which have not broken into three or more pieces.

The report shall show the percentage loss of weight and the results of the qualitative examination.

Rock that fails to meet the requirements stated in a, b, and c above, may be accepted only if similar rock from the same source has been demonstrated to be sound after 5 years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated for the rock to be installed under this specification.

3. GRADING

The rock shall conform to the specified grading limits after it has been placed in the riprap.

MATERIAL SPECIFICATION

531. PORTLAND CEMENT

1. SCOPE

This specification covers the quality of portland cements.

2. QUALITY

Portland cement shall conform to the requirements of ASTM Specification C 150 for the specified types of cement, except that, when Type I portland cement is specified, Type IS portland blast-furnace slag cement or Type IP portland-pozzolan cement conforming to the requirements of ASTM Specification C 595 may be used unless prohibited in the specifications.

If air-entraining cement is to be used, the Contractor shall furnish the manufacturer's written statement giving the source, amount and brand name of the air-entraining addition.

3. STORAGE AT THE CONSTRUCTION SITE

Cement shall be stored in such a manner as to be protected from weather, dampness or other destructive agencies. Cement that is partially hydrated or otherwise damaged will be rejected.

MATERIAL SPECIFICATION

532. AIR-ENTRAINING ADMIXTURES (FOR CONCRETE)

1. SCOPE

This specification covers the quality of air-entraining admixtures for concrete.

2. QUALITY

Air-entraining admixtures shall conform to the requirements of ASTM Specification C 260, except that the relative durability factor in the freezing and thawing test shall be not less than 95.

MATERIAL SPECIFICATION

534. CURING COMPOUND (FOR CONCRETE)

1. SCOPE

This specification covers the quality of liquid membrane-forming compounds suitable for spraying on concrete surfaces to retard the loss of water during the curing process.

2. QUALITY

The curing compound shall meet the requirements of ASTM Specification C 309.

Unless otherwise specified the compound shall be Type 2.

3. DELIVERY AND STORAGE

All curing compound shall be delivered to the site of the work in the original container bearing the name of the manufacturer and the brand name. The compound shall be stored in a manner to prevent damage to the containers and to protect water-emulsion types from freezing.

MATERIAL SPECIFICATION

535. PREFORMED EXPANSION JOINT FILLER

1. SCOPE

This specification covers the quality of preformed expansion joint fillers for concrete.

2. QUALITY

Preformed expansion joint filler shall conform to the requirements of ASTM Specification D 1752, Type I, Type II or Type III, unless bituminous type is specified. Bituminous type preformed expansion joint filler shall conform to the requirements of ASTM Specification D 994, or D 1751.

MATERIAL SPECIFICATION

537. NON-METALLIC WATERSTOPS

1. SCOPE

This specification covers non-metallic waterstops for use in joints of concrete structures.

2. CLASSIFICATION

A. Classes. Non-metallic waterstops shall be of the following classes, as specified:

Class I shall be made of either natural or synthetic rubber.

Class II shall be made of vinyl chloride polymer or copolymer.

b. Types. Non-metallic waterstops may be either split or solid and shall conform to the following types, as specified (see Figure 1):

Type A shall have ribbed anchor flanges and a smooth web. Flanges may be of uniform thickness or may have either a converging or a diverging taper toward the edges.

Type B shall have ribbed anchor flanges and a smooth web containing a hollow tubular center bulb having: (1) a wall thickness equal to at least one-half the web thickness and (2) the inside diameter (D) specified in the contract. Flanges may be of uniform thickness or may have either a converging or a diverging taper toward the edges.

Type C shall have a single, circular, bulb-type anchor flange at each edge and a smooth web.

Type D shall have a single, circular, bulb-type anchor flange at each eadge and a smooth web containing a hollow tubular center bulb having: (1) a wall thickness equal to at least one-half the thickness of the web and (2) the inside diameter (D) specified in the contract.

Type E shall have ribbed anchor flanges and a web molded or extruded in the form of a round or U-shaped bulb of the dimensions specified in the contract. The web bulb shall be connected at the open end of the "U" by a thin membrane (having a thickness of not less than 1/64-inch or more than 1/5 the web thickness) designed to: (1) prevent infiltration of wet concrete into the bulb and (2) tear when expansion of the joint occurs. Flanges may be of uniform thickness or may have either a converging or a diverging taper toward the edges. Auxiliary positioning or nailing flanges may be provided so long as they do not interfere with the functioning of the web bulb.

Type F shall have ribbed anchor flanges with at least two extra heavy ribs (designed to resist displacement of the waterstop during placement of concrete) on each flange and a smooth web having a positioning or nailing flange attached at the center.

Type G shall be of special design conforming to the details shown on the drawings.

c. Sizes. Waterstops of Types A through F shall be of the sizes listed herein, as specified (see Table 1). Type G waterstops shall have the dimensions shown on the drawings.

3. PHYSICAL REQUIREMENTS

The extruded or molded materials shall exhibit the properties specified herein when tested by the methods specified in Section 4 of this specification.

a. Class I Waterstops

(1) The hardness (Shore A durometer) shall be not less than 60.

(2) The specific gravity shall be not more than 1.2.

(3) The tensile strength shall be not less than 2500 pounds per square inch.

(4) The ultimate elongation shall be not less than 450 percent.

(5) The compression set shall be not more than 30 percent.

(6) The water absorption (by weight) shall be not more than 5 percent.

(7) The decrease in tensile strength and ultimate elongation after aging shall be not more than 20 percent.

(8) There shall be no sign of failure due to brittleness at a temperature of minus 35°F.

b. Class II Waterstops

(1) The hardness (Shore A durometer) shall be not less than 60.

(2) The specific gravity shall be not more than 1.4.

(3) The tensile strength shall be not less than 1400 pounds per square inch.

(4) The ultimate elongation of the web shall be not less than 280 percent and that of the flanges shall be not less than 200 percent.

(5) The water absorption (by weight) shall be not more than one percent.

(6) There shall be no sign of failure due to flange brittleness at a temperature of 0°F nor of web brittleness at a temperature of minus 35°F.

(7) The decrease in either tensile strength or ultimate elongation after accelerated extraction shall be not greater than 15 percent.

(8) As a result of the effects of alkalies:

   (a) After immersion for 7 days, the sample shall exhibit no loss of weight and not more than 0.25 percent increase in weight, and the hardness (Shore A) of the treated sample shall differ from that of the untreated sample by not more than plus 5 points or minus 5 points.

   (b) After immersion for 30 days, the sample shall exhibit no loss of weight and not more than 0.40 percent increase in weight, and the dimensions of the treated sample shall not differ from those of the untreated sample by more than one percent.

4. TEST METHODS

Testing shall be done by the methods cited herein. All cited test methods are included in Federal Test Method Standard No. 601.

a. Hardness shall be determined by Method 3021.

b. Specific gravity shall be determined by Method 14011.

c. Tensile strength shall be determined by Method 4111.

d. Ultimate elongation shall be determined by Method 4121.

e. Compression set shall be determined by Method 3311.

f. Water absorption shall be determined by Method 6631.

g. Tensile strength and ultimate elongation after aging shall be determined by Method 7111.

h. Brittleness shall be determined by Method 5311.

i. Accelerated extraction shall be accomplished by Method 6111 under the following conditions:

   (1) Samples shall be not less than 1/16-inch nor more than 1/8-inch in thickness;

   (2) The immersion medium shall be a solution made by dissolving 5 grams of chemically pure sodium hydroxide and 5 grams of chemically pure potassium hydroxide in one liter of distilled water;

   (3) The samples shall be immersed in the medium for 14 days at a temperature of 145° ± 5°F;

   (4) During the immersion period, air shall be gently bubbled through the medium from a 1/4-inch glass tube at a rate of about one bubble per second;

   (5) Fresh medium shall be substituted every day;

   (6) Samples need not be dipped in acetone.

j. The effects of alkalies shall be determined by Method 6251 under the following conditions:

   (1) Sample shall be not more than 1/4-inch in thickness;

   (2) The immersion medium shall be as described in (i), above;

   (3) Fresh medium shall be substituted every 7 days.

   (4) The samples shall be immersed in the medium for a period of 30 days;

   (5) Samples need not be dipped in acetone.

5. CONDITION

Waterstops shall be extruded or molded in such a manner that the material is dense and homogeneous throughout and free from voids, tears, thins, indentations, or other imperfections. Unless otherwise specified, waterstops shall be symmetrical in shape and uniform in dimensions and shall be furnished in continuous strips at least 50 feet long. Factory splices shall have a tensile strength equal to at least one-half that of the unspliced Section.

6. PACKAGING AND STORING

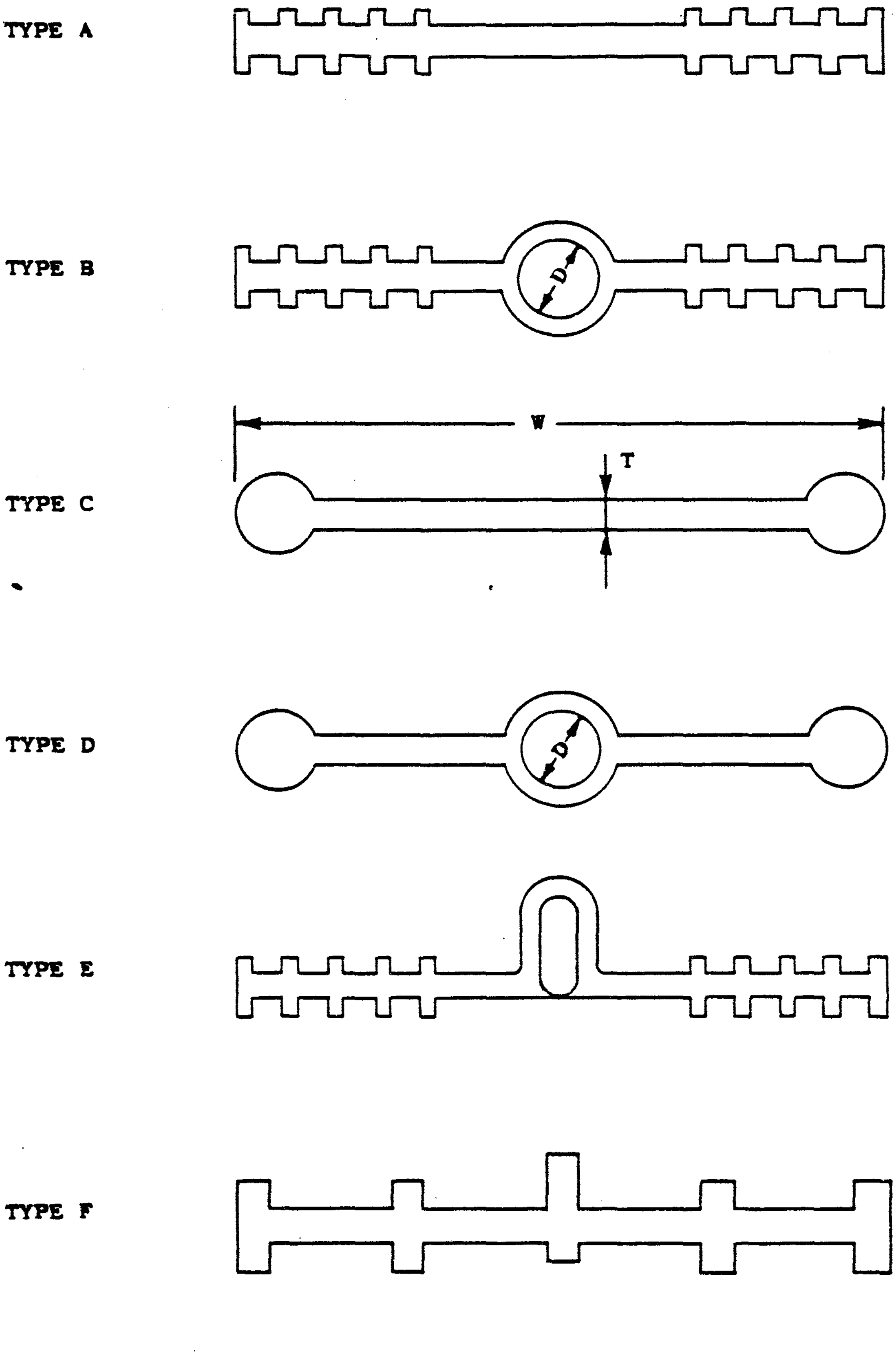
Waterstops shall be packaged and stored by methods that will protect them from prolonged exposure to direct sunlight or excessive heat.

TABLE 1. SIZES OF WATERSTOPS

Size Designation	Web Thickness (T) (Inches)	Width (W) (Inches)
1	1/16	5 1/4
2	3/32	3 3/4
3	3/32	4
4	3/32	5 1/4
5	3/32	6
6	1/8	4
7	1/8	5 1/4
8	1/8	6
9	5/32	4
10	5/32	4 1/2
11	5/32	9
12	3/16	4
13	3/16	5
14	3/16	6
15	3/16	9
16	1/4	6
17	1/4	9
18	3/8	5
19	3/8	6
20	3/8	9
21	1/2	6
22	1/2	9
23	1/2	12

FIGURE 1

TYPES OF NON-METALLIC WATERSTOPS



MATERIAL SPECIFICATION

538. METAL WATERSTOPS

1. SCOPE

This specification covers the quality of materials for metal waterstops.

2. MATERIALS

Metal waterstops shall be made of copper or galvanized steel as specified. Waterstops that require forming of the metal involving sharp bends shall be made of copper which shall be soft enough to stand being bent cold through 180 degrees at an inside radius equal to its thickness without cracking.

3. QUALITY

Metal for waterstops shall conform to the requirements of the applicable ASTM standard specifications below:

Copper - ASTM Specification B 152

Zinc-coated (Galvanized) steel - ASTM Specification A 526

MATERIAL SPECIFICATION

551. ZINC-COATED IRON OR STEEL CORRUGATED PIPE

1. SCOPE

This specification covers the quality of zinc-coated iron or steel corrugated pipe and fittings.

2. PIPE

Zinc-coated iron or steel corrugated pipe and fittings shall conform to the requirements of Federal Specification WW-P-405 for the specified classes and shapes of pipe, and to the following additional requirements:

a. Unless otherwise specified, circumferential shop riveted seams shall have a maximum rivet spacing of 6 inches, except that 6 rivets will be sufficient for 12-inch diameter pipe;

b. When close riveted pipe is specified: (1) the pipe shall be fabricated so that the rivet spacing in the circumferential seams shall not exceed 3 inches, except that 12 rivets will be sufficient to secure the circumferential seams in 12-inch pipe, and (2) in those portions of the longitudinal seams that will be covered by the coupling bands the rivets shall have finished flat heads or the rivets and holes shall be omitted and the seams shall be connected by welding to provide a minimum of obstruction to the seating of the coupling bands.

c. Double riveting or double spot welding or pipe less than 42 inches in diameter may be required. When double riveting or double spot welding is specified, the riveting or welding shall be done in the manner specified for pipe 42 inches or greater in diameter.

3. COATINGS

Coatings shall conform to the requirements of Federal Specification WW-P-405 for the specified types of coatings.

MATERIAL SPECIFICATION

552. ALUMINUM CORRUGATED PIPE

1. SCOPE

This specification covers the quality of aluminum corrugated pipe and fittings.

2. PIPE

Aluminum corrugated pipe and fittings shall conform to the requirements of Federal Specification WW-P-402 for the specified classes and shapes of pipe, and to the following additional requirements:

a. When close riveted pipe is specified: (1) the pipe shall be fabricated so that the rivet spacing in the circumferential seams shall not exceed 3 inches, except that 12 rivets will be sufficient to secure the circumferential seams in 12-inch pipe; and (2) in those portions of the longitudinal seams that will be covered by the coupling bands the rivets shall have finished flat heads or the rivets and holes shall be omitted and the seams shall be connected by welding to provide a minimum of obstruction to the seating of the coupling bands.

b. Double riveting of pipe less than 42 inches in diameter or double spot welding or pipe less than 30 inches in diameter may be required.

   When double riveting or double spot welding is specified, the riveting or welding shall be done in the manner specified for pipe of greater diameter.

3. COATINGS

Coatings shall conform to the requirements of Federal Specification WW-P-402 for the specified types of coatings.

MATERIAL SPECIFICATION

581. METAL

1. SCOPE

This specification covers the quality of steel and aluminum alloys.

2. STRUCTURAL STEEL

Structural steel shall conform to the requirements of ASTM Specification A 36.

High-strength low-alloy structural steel shall conform to ASTM Specification A 242 or A 588.

Carbon steel plates of structural quality to be bent or formed cold shall conform to ASTM Specification A 283, Grade C.

Carbon steel sheets of structural quality shall conform to ASTM Specification A 570, Grade D or A 611, Grade D.

Carbon steel strip of structural quality shall conform to ASTM Specification A 570, Grade C.

3. COMMERCIAL OR MERCHANT QUALITY STEEL

Commercial or merchant quality steel shall conform to the requirements of the applicable ASTM specifications listed below:

Product	ASTM Specification
Carbon steel bars	A 575, Grade M 1015 to Grade M 1031
Carbon steel sheets	A 569
Carbon steel strip	A 569
Zinc-coated carbon steel sheets	A 526

4. ALUMINUM ALLOY

Aluminum alloy products shall conform to the requirements of the applicable ASTM specifications listed below. Unless otherwise specified, alloy 6061-T6 shall be used.

Product	ASTM Specification
Standard structural shape	B 308
Extruded structural pipe and tube	B 429
Extruded bars, rods, shapes and tube	B 221

Drawn seamless tubes	B 210
Rolled or cold-finished bars, rods and wire	B 211
Sheet and plate	B 209

5. Bolts

Steel bolts shall conform to the requirements of ASTM Specification A 307. If high-strength bolts are specified they shall conform to the requirements of ASTM Specification A 325.

When galvanized or zinc-coated bolts are specified, the zinc coating shall conform to the requirements of ASTM Specification A 153; except that bolts 1/2 inch or less in diameter may be coated with electrodeposited zinc or cadmium coating conforming to the requirements of ASTM Specification B 633, Service Condition SC 3, or ASTM Specification A 165, Type TS, unless otherwise specified.

6. RIVETS

Unless otherwise specified, steel rivets shall conform to the requirements of ASTM Specification A 502, Grade 1. Unless otherwise specified, aluminum alloy rivets shall be Alloy 606-T6 conforming to the requirements of ASTM Specification B 316.

7. WELDING ELECTRODES

Steel welding electrodes shall conform to the requirements of American Welding Society specification AWS A5.1. "Specification for Mild Steel Covered Arc-Welding Electrodes," except that they shall be uniformly and heavily coated (not washed) and shall be of such a nature that the coating will not chip or peel while being used with the maximum amperage specified by the manufacturer.

Aluminum welding electrodes shall conform to the requirements of American Welding Society specification AWS A5.10, "Specification for Aluminum and Aluminum-Alloy Welding Rods and Bare Electrodes."

MATERIAL SPECIFICATION

582. GALVANIZING

1. SCOPE

This specification covers the quality of zinc coatings applied to iron and steel products.

2. QUALITY

Zinc coatings shall conform to the requirements of the following specifications.

Zinc coatings on products fabricated from rolled, pressed, and forged steel shapes, plates, bars, and strip, 1/8 inch thick and heavier shall conform to ASTM Specification A 123.

Zinc coatings on assembled steel products shall conform to the requirements of ASTM Specification A 386 and shall be applied in conformance with the Recommended Practice for Providing High Quality Zinc Coatings (Hot-Dip) on Assembled products (ASTM Designation A 385).

Zinc coatings on iron and steel hardware shall conform to the requirements of ASTM Specification A 153 except that bolts, screws and other fasteners -1/2 inch or less in diameter may be coated with electrodeposited zinc or cadmium coating conforming to the requirements of ASTM Specification A 165, Type TS, or ASTM Specification B 633, Service Condition SC-3 unless otherwise specified.

CONTRACT DRAWINGS